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No. 29

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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

ENGINEERING AND EQUIPMENT

No. 29

This serial publication contains abstracts of articles from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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CONTENTS	PAGE
ENGINEERING	
Acoustical	1
Aeronautical and Space	3
Construction	13
Heat, Combustion, Detonation	23
Industrial and Power	34
Marine and Shipbuilding	39
Materials	41
Metrology	54
Mining, Geological	56
Stress Analysis and Stability Studies	58
Turbine and Engine Design	70
EQUIPMENT	
Gyroscopic	74
Measuring, Testing	76
Power	80

USSR

UDC 534.2:532

ON THE REFLECTION OF THE SHOCK WAVE OF AN INTERNAL SONIC WAVE

SBORNIK TRUDOV NAUCHNO-ISSLEDOVATEL'SKOGO ENERGETICHESKOGO INSTITUTA IMENI G. M. KRZHIZHANOVSKOGO [Collection of Works of the Scientific Research Energy Institute imeni G. M. Krzhizhanskovskiy] in Russian, No 42, 1975 pp 84-88

PLESHANOV, A. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B277 by M. P. Mikhaylova]

[Text] The author examines the reflection of a sonic wave of a shock wave in an ideal gas. He notes that with two values of the angles of incidence the sonic wave upon reflection introduces only entropy-vortex perturbations; thus these angles merge into one with a ratio of heat capacitances equal to 1. He gives the graphs of the dependence of sizes of the angles on the Mach number of the shock wave M_0 , and also graphs for the two values of M_0 and two values of γ , from which the angle of reflection of the sonic wave is determined from the angle of incidence, and the graphs of the ratio of pressure amplitudes of the reflected and incident sonic waves as a function of the angle of incidence. References 6.

USSR

UDC 534.2:532

DIFFRACTION OF AN ACOUSTICAL WAVE INSIDE A HOLLOW WEDGE

Moscow NAUCHNYYE TRUDY. INSTITUT MEKHANIKI. MOSKOVSKIY UNIVERSITET [Scientific Annals. Institute of Mechanics, Moscow University] in Russian, No 41, 1975 pp 115-129

GUVERNYYUK, S. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B278 by Ye. F. Afanas'yev]

[Text] The author assumes that a plane acoustical wave of unique intensity in the initial moment of time reaches the wall of the rigid hollow wedge and begins to diffract at its edges and is reflected inside. The front of the incident wave is perpendicular to the bisector of the wedge. He constructs the wave pattern for six different values of the wedge span. In all cases he finds the solution in the region of the so-called "blind flow", in the region of diffraction of the point and in other regions.

Basically he uses the method of characteristics and in several of the regions the method of S. A. Chaplygin which leads to a solution of the equations of elliptical type. On the basis of the obtained solutions he determines the specific axial load on the wedge.

USSR

UDC 534.2:532

SOUND SHOCK FROM AN AIRPLANE DURING FLIGHT ALONG AN ARBITRARY TRAJECTORY IN A STRATIFIED ATMOSPHERE WITH A THREE-COMPONENT WIND

Moscow AEROMEKHANIKA [Aeromechanics, Collection of Works] in Russian, Izd-vo Nauka, 1976 pp 73-86

ZHILIN, YU. L.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B279 by the author]

[Text] The general theory of sound shock is used to investigate the sound shock from an airplane flying in a stratified atmosphere with a three-component wind, all the parameters of which depend only on altitude above the Earth's surface. For such a model of the atmosphere the computation of the attenuation factor is reduced to four quadratures. The author shows that with the assigned state of the atmosphere the attenuation factors depend only on five parameters of similarity. These parameters characterize the regime of airplane flight and the position of the observer perceiving the sound shock relative to the flight path. References 19.

USSR

UDC 531/539

STABLE POSITIONS OF EQUILIBRIUM OF TWO CONNECTED BODIES IN LOW ORBITS

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied Mechanics -- Collection of Works] in Russian 1974 pp 305-312

DOKUCHAYEV, L.V., Moscow Institute of Physics and Technology

[Abstract] Stable positions of equilibrium are determined for two satellites connected together by an inextensible thin weightless thread which performs libration motion in the orbital plane under the influence of both gravitational and aerodynamic forces. Nine modes of coupled motion are distinguished depending on the value of the energy constant. Five modes correspond to oscillation of the system relative to two stable positions. When there is no atmosphere, the two stable positions are directed along a radius vector. As the density of the atmosphere increases, the positions of stable equilibrium begin to deflect differently from the vertical. For low orbits, there is only one position of stable equilibrium. 2 references.

USSR

UDC 531/539

USE OF THE DYNAMICS OF RELATIVE MOTION IN THE CONTROL OF ROTATIONAL MOTION

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied Mechanics -- Collection of Works] in Russian 1974 pp 333-339

ZUBOV, V.I., Leningrad State University

[Abstract] A study is made of the problem of control of the rotational motion of a solid. This analysis produces the form of control moments, the influence of which either leads to orientation of the rotational body in an assigned direction, or to scanning of axes coupled to the body according to an assigned program. It is also demonstrated that the moments mentioned can be created using coriolis forces arising upon relative motion of bodies connected in some manner to a controlled lifting body.

USSR

UDC 629.7.036.3:533.6

STUDY OF GROUP PROPERTIES OF THE EQUATIONS OF THE BOUNDARY LAYER WITH
CHEMICAL REACTIONS AND VARIABLE VISCOSITY

TR. KAZAN. AVIATS. IN-TA in Russian No 169, 1975 pp 57-68

OVCHINNIKOV, V. A. and PAVLOV, V. G.

[From REFERATIVNYY ZHURNAL AVIATSIONNYYE I RAKETNYYE DVIGATELI No 9 1976
Abstract No 9.34.12]

[Text] A group classification is presented of a system of differential equations describing a binary boundary layer when there are chemical reactions; classes of invariant solutions of first rank are constructed, for which the initial system is reduced to a system of ordinary differential equations; numerical calculations of the boundary layer characteristics are presented in the area of the critical point for the case of ideal mixtures with special boundary conditions (injection of fluid into the boundary layer at moderate velocity). 3 figures, 1 table, 3 references.

USSR

UDC 629.7.036.3:536.46

STUDY OF FLAME TRANSFER BETWEEN FLAME STABILIZERS

Ufa ISPYTANIYA AVIATS. DVIGATELEY in Russian No 3, 1975 pp.154-160

KHACHUTURYAN, O. A.

[From REFERATIVNYY ZHURNAL AVIATSIONNYYE I RAKETNYYE DVIGATELI No 9 1976
Abstract No 9.34.20 from the resume]

[Text] Results are presented from an experimental study of flame transfer between gas dynamic prechambers and poorly streamlined bodies in the form of discs. Based on the model suggested, a flame transfer parameter is introduced with which an attempt is made to summarize the experimental data produced. 8 figures, 6 references.

USSR

UDC 531.36:531.31:531.391.5

STABILITY AND OSCILLATIONS OF GYROSTATS IN CIRCULAR ORBIT

Kiev IV VSESOYUZNIY S"YEZD PO TEORETICHESKOY I PRIKLADNOY MEKH-
NIKE, 1976 [Fourth All-Union Conference on Theoretical and Ap-
plied Mechanics, 1976, Collection of Works] in Russian, Annota-
tions of Reports, Izd-vo Naukova Dumka, 1976 p 35

SMOL'NIKOV, B. A.

[From REFERATIVNIY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10A130]

[Text] The author constructs a modified system of equations of
gyrostat equilibrium in the orbital axes and shows the classes of
equilibrium characteristic of noncollinearity of the major and
orbital axes. For arbitrary positions of equilibrium he con-
structs a Lyapunov function and equations of small oscillations
of the gyrostat around its center of mass. For the case of an
axysymmetric ellipsoid of inertia of a gyrostat it was shown
that depending on the size and direction of the vector of the
hydrostatic moment the number of positions of equilibrium varies
from 4 to 8. The author determines the regions of stability as
well as the frequencies and forms of the small gyrostat oscilla-
tions near the equilibrium positions. For a nonsymmetrical gyro-
stat he studies the equilibrium position in those cases when the
vector of the hydrostatic moment has one or two nonzero project-
ions on its major axes of inertia. He compares the conditions
of stability and constructs the corresponding regions on the
plane of the parameters. Annotation.

USSR

UDC 62-50

STRICT LOCAL OPTIMALITY OF TRAJECTORIES OF DYNAMIC SYSTEMS WITH
DISCONTINUOUS PHASE COORDINATES

Kiev IV VSESOYUZNIY S"YEZD PO TEORETICHESKOY I PRIKLADNOY MEKH-
NIKE, 1976 [Fourth All-Union Conference on Theoretical and Ap-
plied Mechanics, 1976, Collection of Works] in Russian, Annota-
tions of Reports, Izd-vo Naukova Dumka, 1976 p 24

IL'YIN, V. A.

[From REFERATIVNIY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10A140]

[Text] For dynamic systems with discontinuous phase coordinates
the author examines the Mayer problem of functional minimization
which depends on the norms of sudden vector jumps of discontinuous

phase coordinates at the points of discontinuity. He obtains an expression for a variation in the functional upon adding a small sudden jump in the norm. Conditions are formulated for strict local optimality which permits isolating from the stationary trajectories the optimals which convey the minimum to the functional (analog of the L. S. Pontryagin principle of the maximum). He demonstrates the method of transition from a nonoptimal trajectory to a trajectory with a large number of jumps, for which a decrease in functional takes place in linear approximation. As an example he examines the problem of optimizing the impulse trajectories of space craft and gives the results of the computation. Annotation.

USSR

UDC 531.55:521.1

MAGNETIC CORRECTION SYSTEM OF THE KINETIC MOMENT FOR PRECISELY STABILIZED SPACE CRAFT

KOSMICHESKOYE ISSLEDOVANIYE NA UKRAINE. RESPUBLIKANSKIY MEZHVEDOMSTVENNIY SBORNIK [Space Research in the Ukraine. Republic Interdepartmental Collection] in Russian, No 8, 1976 pp 92-95

ALPATOV, A. P. and KHOROSHILOV, V. S.

[From REFERATIVNIY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10A166 by the authors]

[Text] The authors study the design features of a magnetic correction system (MCS) of the kinetic moment of a space craft with a precision system of orientation. They examine the possibility of correcting a space craft kinetic moment by a correcting moment approximately equal in value to the perturbed moment. They synthesize the algorithm of MCS control with a discontinuous functioning circuit. The obtained results can be used for constructing space craft orientation systems that are invariant to the external perturbations. References 5.

USSR

UDC 531/539

THE STABILITY OF THE ORIENTATION OF A GYROSTAT SATELLITE IN EQUILIBRIUM
POSITIONS AT THE LIBRATION POINTS

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied
Mechanics -- Collection of Works] in Russian 1974 pp 605-616

RUMYANTSEV, V.V., Moscow Computer Center, Acad. Sci. USSR

[Abstract] A study is made of the generalized limited circular three body problem in the case when the passively gravitating body (satellite) is a gyrostatt with a central three-axis ellipsoid of inertia. Three sets of positions of relative equilibrium of the satellite are indicated, in which its center of mass is located at one of the libration points close to the libration points of the limited circular problem of three point bodies. Assuming that due to the slight additional balancing forces applied to the satellite its center of mass remains always at one of the libration points, sufficient conditions are found for stability of orientation of the satellite in its equilibrium positions. 5 references.

USSR

UDC 531/539

AN ELECTROMAGNETIC SYSTEM FOR RELIEVING THE KINETIC MOMENT OF ARTIFICIAL
EARTH SATELLITES ORIENTED IN AN ORBITAL SYSTEM OF COORDINATES

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied
Mechanics -- Collection of Works] in Russian 1974 pp 133-142

BIKHMAN, R.I., SHEREMET'YEVSKIY, N.N., METP Scientific and Technical Council,
Moscow

[Abstract] A description is presented of an electromagnetic system for compensation of the impulse of external perturbing moments acting on a satellite oriented in an orbital system of coordinates, as well as the possibility of using this system to damp the angular velocity of the satellite. The basic principles of construction of the system and optimization of its parameters are discussed. Experimental results are presented. The authors conclude that magnetic torque motors are most suitable for use in satellites in near-earth orbits (orbital radius up to several thousands of kilometers), since this does not require the consumption of propulsion fluid and allows the minimum weight of the orientation system to be achieved with high operational reliability. 2 references.

USSR

UDC 532.526

EXPERIMENTAL INVESTIGATION OF HEAT EXCHANGE ON A FLAT PERMEABLE SURFACE DURING ALTERNATION OF SEGMENTS OF BLASTING AND SUCTION

Minsk TEPLOMASSOOBMEN [Heat and Mass Exchange, Collection of Works] in Russian, Vol 1, Part 1, 1976 pp 123-125

LEONT'YEV, A. I., ROZHDESTVENSKIY, V. I., VINOGRADOV, YU. A. and SYSOYEV, V. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B209 by V. A. Barinov]

[Text] The authors report on the results of an experimental investigation of the result of suction on the size of the thermal flux toward the surface segments. Alternation of sections of suction and blasting exists in a number of high-temperature energy devices for the prevention of discontinuity in a supersonic stream and cooling of the wall. The experiment was conducted at a flow rate corresponding to a Mach number $M = 2.25$. The model of the heat-exchange segment consisted of 8 segments of blasting and 8 sections of suction with an expanse of 16 and 6 mm, respectively. The permeable surface was prepared by the method of hot rolling from a package of metal wire grids. The thermal fluxes were determined by the method of a stationary heat regime. They give the results of the measurements of the thermal flux with different suction intensity.

USSR

UDC 533.6.011.72

COMPUTATION OF THE RADIATION COOLING OF AIR BEHIND STRONG SHOCK WAVES USING AVERAGE OPTICAL CHARACTERISTICS

Minsk TEPLOMASSOOBMEN - V. MATERIALY V VSESSOYUZNOY KONFERENTSII PO TEPLOMASSOOBMENU [Heat and Mass Exchange - V. Materials from the Fifth All-Union Conference on Heat and Mass Exchange, Collection of Works] in Russian, Vol 8, 1976 pp 196-205

ZAMURAYEV, V. N., MASLENNIKOVA, I. I. and SOLOUKHIN, R. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B264 by V. G. Voronkin]

[Text] The authors describe a method of determining the average coefficients of air absorption and its use for computing radiation cooling of air behind a strong shock wave. The spectrum was divided into a series of intervals, in each of which the

spectral coefficient of absorption replaced the average one defined as the mean geometric one from the Planck and Rosseland coefficients of absorption. When the spectrum was divided into intervals the authors isolated regions where the lines play a small role and two regions where the lines play a basic role. The last two regions were divided then into several regions based on the size of the ratio of the total coefficient of absorption to the coefficient of absorption in the continuous spectrum. As a result they obtained a division into nine intervals. In the computations they took into account the most important systems of bands of molecules of O_2 , N_2 , NO and N_2^+ . From the continuous molecular processes of absorption they took into account the photodissociation of O_2 and N_2 molecules and photoionization of N^- and O^- . In the line spectrum of the high-temperature air they took into account 145 lines of atomic nitrogen, oxygen and their ions. By using this method they were able to examine the state of the gas behind a strong plane shock wave propagating in air. They assumed thermodynamic equilibrium behind the shock wave. The thickness of the emitting layer of gas behind the shock wave varied. The system of equations was solved numerically. The computations were made at a velocity of the shock wave of 12 - 18 km/sec, pressure of the unperturbed air of 10^{-3} - 10^{-5} technical atmospheres and thickness of the emitting layer of 1 - 100 cm. They obtained profiles of the parameters, especially the temperature and radiation flux within the emitting layer. In all examined cases the pressure depends weakly on emission, unlike temperature and density. References 8.

USSR

UDC 531/539

THE MECHANISM OF FORMATION OF NORMAL FORCE UPON FLAPPING OF WINGS

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKhanIKI [Selected Problems of Applied Mechanics -- Collection of Works] in Russian 1974 pp 97-102

BELOTSEKOVSKIY, S.M., GULYAYEV, V.V., NISHT, M.I., Central Institute of Aerodynamics and Hydrodynamics, Moscow

[Abstract] Studies of the flight of *Encarsia formosa* have shown that its flight characteristics are significantly superior to those of other insects. This article analyzes the flight of *Encarsia formosa* from the standpoint of classical hydrodynamics. The formation of the lift during the stage of takeoff of the insect is studied. It is shown that in addition to the influence of the second wing and the presence of initial circulation, the influence of the separated flow mode is quite significant. The noncirculation plan, even during the stage of opening of the wings, yields qualitatively different results. 8 references.

USSR

UDC 532.517.4

EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF TURBULENCE LEVEL
ON INITIAL SEGMENT OF AXISYMMETRIC TURBULENT SUBMERGED STREAM

Ufa ISPITANIYA AVIATIONNYKH DVIGATELEY [Aviation Engine Tests,
Collection of Works] in Russian, No 3, 1975 pp 161-169

ZHADIN, I. G.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10B141 by the author]

[Text] The author gives the results of an experimental investigation of the initial segment in the propagation of an axisymmetric turbulent isothermal submerged stream with a variable initial turbulence intensity level. He demonstrates that the increase in turbulence intensity leads to a significant reduction in the length of the center and growth in the thickness of the mixing layer. He established that with change in initial turbulence intensity level the dimensionless profiles of the average velocity and longitudinal component of the pulsation velocity in the limits of the initial segment remain unchanged. On the basis of generalizing the experimental material he derives formulas for computing the parameters of the stream both in the center and in the mixing layer. References 9.

USSR

UDC 532.526

INFLUENCE OF PERTURBATIONS OF THE EXTERNAL FLOW ON THE STATE OF
A BOUNDARY LAYER

Kiev IV VSESOYUZNIY S"YEZD PO TEORETICHESKOY I PRIKLADNOY MEKH-
NIKE, 1976 [Fourth All-Union Conference on Theoretical and Ap-
plied Mechanics, 1976, Collection of Works] in Russian, Annota-
tions of Works, Izd-vo Naukova Dumka, 1976 p 71

POLYAKOV, N. F.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10B169]

[Text] The author cites the results of an experimental investigation of the structure of wave phenomena in an incompressible boundary layer with a zero pressure gradient by allowing for the nature, intensity and energy spectra of the external perturbations. He shows that with pressure distribution on the working surface near the streamlining of the mathematically idealized model of a

flat plate, the dependence of the Reynolds number of transition to the turbulent boundary layer on the degree of turbulence of the flow differs from the widely used results of Schubauer and Skremstedt. He mentions that the Reynolds numbers of the transition depend substantially on the pressure distribution near the leading edge. He establishes that the natural transition even with a degree of turbulence less than 0.1% is caused by the external perturbations. He gives the results of an investigation on the influence of sound, turbulence of the flow and the vibrations of the plate on the structure of the perturbations in a laminar boundary layer and the character of the transition to turbulent flow. Annotation.

USSR

UDC 534

PROBLEMS IN NONLINEAR MECHANICS IN VIBRATION TECHNOLOGY ON EARTH AND IN SPACE

Kiev IV VSESOUZNIY S"YEZD PO TEORETICHESKOY I PRIKLADNOY MEKH-
NIKE, 1976 [Fourth All-Union Conference on Theoretical and Ap-
plied Mechanics, 1976, Collection of Works] in Russian, Annota-
tions of Reports, Izd-vo Naukova Dumka, 1976 p 17

GANIYEV, R. F.

[From REFERATIVNIY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10A195]

[Text] The author discusses the results of theoretical and ex-
perimental investigations of nonlinear oscillations and movement
stability of systems of bodies with a liquid, gas and solid part-
icles with controllable vibration effects. The examined dynamic
objects are mathematical processes both under Earth conditions
and in space. He formulates the problems and analyzes the new
nonlinear effects detected during the investigation of the dy-
namic behavior of the examined systems under periodic controllable
effects. He discusses the possibilities of using the established
effects upon satisfaction of the technological operations in the
field of metallurgy, chemical technology, degassing of fuel, etc,
on Earth and in space. He analyzes the new formulations, the con-
trol and, especially, vibration processes of the technology. An-
notation.

ON THE POSSIBILITIES OF A SUPERSONIC STREAM AND AERODYNAMIC FORCES
ARISING ON A STREAMLINING SURFACE DURING FLUID INJECTION

KOMICHESKIYE ISSLEDOVANII NA UKRAINE. RESPUBLIKANSKIY MEZHVEDOMST-
VENNIY SBORNIK [Space Research in the Ukraine. Republic Interde-
partmental Collection] in Russian, No 8, 1976 pp 36-43

KOVALENKO, N. D.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10B800 by the author]

[Text] The author examines the three-dimensional problem on perturbations of a supersonic stream and aerodynamic forces arising on a streamlining surface during fluid injection. In the entire region of interaction the author separates the characteristic zones of nonadiabatic, adiabatic and separating flows. Fluid injection is accomplished at high speed when the flow in the nonadiabatic zone is equivalent to the flow of gas in the presence of mass and heat sources. As a result of the theoretical analysis the author obtains relationships for perturbations of the parameters and boundaries of the characteristic zones. Within the framework of the linearized theory for a one-dimensional function of heat and mass supply the author solves the problem on perturbations of a supersonic stream in a Laval nozzle of an aircraft engine. By using a series of simplifications the author obtains relationships for perturbations in pressure, and lateral and axial forces. With a coefficient of $\phi = 0.52$ which takes into account the completeness of burning (evaporation) of the fluid in the nozzle and the computational error, the computational data agree satisfactorily with the experiment on injection of different fluids. References 9.

Construction

USSR

UDC 624.131.524.2

EXPERIENCE IN PLANNING AND CONSTRUCTION OF RESIDENTIAL BUILDINGS WITH ELEVATED PRESSURES ON THE SOIL IN MURMANSK

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No. 5, Sep 76
pp 4-6

RUDNITSKIY, N.Ya., MALAKHOVA, K.V., Scientific Research Institute for Foundations, and APOSTOLLI, A.D., Murmanskzhilstroy Trust

[Abstract] As a result of studies performed at the Scientific Research Institute for Foundations, a new method has been developed for planning of foundations in which, in contrast to traditional methods, the subfoundation is based not on the standard soil resistance, but rather considering the actual compressibility modulus and limits of linear deformability of the soils. A new method was tested in Moscow, Kiev and Murmansk, where a significant portion of the geological structure is represented by glacial deposits consisting of fine to coarse sands, gravel, pebble and rocky soils. Considering the high load-bearing capacity of these sandy soils, the Institute recommended that higher pressures on soil be allowed (0.5 MPa) using 0.6 m wide concrete blocks. Observation of the condition of the structures of the buildings showed no deformations of the above-ground portion, and their settling did not exceed the norms. The experience gained in this construction was used in the development of new construction norms and rules. 5 references.

USSR

UDC 624.138.232.1:624.131.272

THE USE OF SILT-CEMENT PILES IN THE CONSTRUCTION OF PORT STRUCTURES

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No. 5, Sep 76
pp 23-25

SOKOLOVICH, V.Ye., MOTUZOV, Ya.Ya., Scientific Research Institute for Foundations, and KOTOV, A.I., Leningrad Institute of Water Transportation

[Abstract] One promising means of construction of port structures in territories consisting of weak silty soils is the use of silt-cement -- an artificial material produced by mixing silty soil with a binder, primarily Portland cement, though more complex compositions including various intensifying additives may also be used. The studies of the authors revealed significant hydrolysis and hydration of the cement binder in the water-saturated silt. The results of the studies indicated that the new material is effective and can be widely used for the construction of foundations in silty soils. Calculations showed that silt-cement pilings are 40% cheaper than reinforced concrete pilings. 3 references.

USSR

UDC 624.191.8.012.4.042.7

CALCULATION OF LININGS OF THE CONSTRUCTION TUNNEL FOR THE SECOND LEVEL OF THE
ROGUNSKAYA HYDROELECTRIC POWER PLANT CONSIDERING SEISMIC EFFECTS

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No. 9, Sep 76 pp 7-10

FOTIYEVA, N.N.

[Abstract] A brief description is presented of a method developed by the author for the design of the interior linings of tunnels of noncircular cross section for seismic effects, based on estimation of the most unfavorable stress state in each cross section of the lining of those possible with various combinations of compression (extension) and shear waves in any direction in the plane of the cross section of the tunnel. Results are presented from calculations for several types of construction tunnel linings for the second level of the Rogunskaya Hydroelectric Power Plant. The calculations showed that forces corresponding to the maximum stresses in linings arise in the arch of the linings, the upper half of the side walls and the bottom with a direction of incident waves near horizontal, in the lower half of the side walls when the direction of incident waves is near vertical. However, one type of lining shows the opposite effect. This complex dependence of stress state of linings on wave direction once again confirms the expediency of selecting the most unfavorable stress state of linings for use in calculations. 7 references.

USSR

UDC 624.191.8.001.24

DESIGN OF CONCRETE TUNNEL LININGS CONSIDERING CHANGES IN THE CALCULATION
PLAN UPON CRACK FORMATION

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No. 9, Sep 76 pp 13-15

MORDOVINA, A.N.

[Abstract] A method is presented for calculating the load-bearing capacity of concrete linings of nonpressurized tunnels considering the formation of plastic hinges. It is shown that the determining factor for such linings is the calculation of crack resistance. The method recommended utilizes the theory of calculation based on limiting states and allows an increase in the design load-bearing capacity of linings in comparison with the capacity calculated according to the method currently in effect, thus expanding the limits of applicability of concrete linings. It is concluded that the best tunnel shape is circular. It is pointed out that the suggested new method of calculation does not provide the same strength reserve as the old methods, obligating engineers to be more cautious in applying the method in consideration of all actual local conditions. 4 references.

USSR

UDC 627.82.012.4.002.56

TESTING THE RELIABILITY OF THE CAYANO-SHUSHENSKAYA HYDROELECTRIC POWER PLANT DAM

Moscow GIDROTEKHNIЧЕСКОYE STROITEL'STVO in Russian No. 9, Sep 76 pp 25-28

ALEKSANDROVSKAYA, E.K., YEFIMENKO, A.I., TEBIN, F.I.

[Abstract] Problems of testing the quality of one of the largest concrete structures in modern water engineering construction is discussed. The testing was performed by various types of testing and measurement apparatus. The results of field testing of temperature modes and thermal stress states performed during the initial period of erection of the structure are presented. During 1974 and 1975, the stresses in the concrete in the sections studied differed both in nature and magnitude. Most sections experienced tensile stresses, reaching $10-15 \text{ kg/cm}^2$ at 30 days curing time. No internal cracks were found in the concrete. The results of observation of the temperature mode and stress state in the main structural sections indicated that flooding could be begun in October of 1975. 3 references.

USSR

UDC 624.131.54.001.5

EXPERIENCE AND EXPERIMENTAL STUDY OF THE REGULARITIES OF DEFORMABILITY AND FLOW OF SOIL UNDER CONDITIONS OF AN EDGE PROBLEM WITH FLAT DEFORMATIONS

Moscow GIDROTEKHNIЧЕСКОYE STROITEL'STVO in Russian No. 9, Sep 76 pp 32-39

LOMIZE, G.M., RYABCHENKOV, L.N.

[Abstract] This article presents the results of an experimental study of the basic regularities of development of a heterogeneous stress state, produced under conditions of the flat-deformation problem of loading of a soil medium around an expanding cavity. The experiments were performed in a special test stand trough measuring $200 \times 120 \text{ cm}$, 175 cm high. Air dry unrolled sand was used in the experiments. The method of studying the stress-strain state, producing the necessary information not only on stress tensors and deformations, but also on the deformation rate tensor, allows experimental determination of the influence of the new factors listed above and therefore serves to facilitate development and application to the practice of planning and scientific research organizations. 5 references.

USSR

UDC 624.21/.8:624.012:691.327:
666.973.45.003.13

THE EFFECTIVENESS OF THE USE OF LIGHT CONCRETES IN BRIDGE CONSTRUCTION

Moscow BETON I ZHELEZOBETON in Russian No. 9, Sep 76 pp 4-8

DELLOS, K.P., Moscow Institute of Motor Vehicles and Roads

[Abstract] Light concrete up to Soviet Grade 500, based on porous fillers, is most widely used in bridge construction. Particularly promising is polymer concrete, or surface saturation of structural elements with polymer, which can increase the compressive strength of light concrete by a factor of 3-4, the tensile strength by a factor of 2-3. The main reasons for the slow growth of the production of structures of light concrete for transport construction purposes include low rates of production growth, as well as the high cost of light fillers suitable for the manufacture of load-bearing high-strength structures; the insufficient state of development of plan decisions and experimental testing of light concrete bridge structures; the lack of a single norm document on the planning and technology of manufacture of light concrete structures; and the lack of study of the questions of the economic effectiveness of the use of light concrete in transport construction. Serious attention must be given to the development of a variety of effective structures of light concrete by specialized organizations. 2 references.

USSR

UDC 691.87:693.554

RELAXATION OF STRESSES IN CLASS At-V AND At-VI REINFORCEMENT FOLLOWING FACTORY MANUFACTURE OF REINFORCED CONCRETE STRUCTURES

Moscow BETON I ZHELEZOBETON in Russian No. 9, Sep 76 pp 21-23

KEVORKOV, V.A., Scientific Research Institute for Reinforced Concrete

[Abstract] The Institute has studied the relaxation of stresses in At-V and At-VI rod reinforcement under conditions of conveyor manufacture of prestressed reinforced concrete structures. It is recommended that the stress relaxation of high strength At-V and At-VI reinforcement be calculated under these conditions by the formula $\sigma_n = 0.03 \sigma_0$ for the mechanical tensioning method, and that it be taken as 0 for the electrothermal method. These recommendations are extended to the design of metal forms in which the resultant force is close to or coincides with the center of the cross section of the form, as well as forms with reverse bending.

USSR

UDC 691.327:666.972.16

COMPARATIVE STUDIES OF CONCRETES WITH VARIOUS COMPLEX ADDITIVES

Moscow BETON I ZHELEZOBETON in Russian No. 10, Oct 76 pp 13-14

GLADKOV, V.S., POLCHKOV, B.I., Central Scientific Research Institute for Construction, Ministry for Transport Construction

[Abstract] In addition to earlier known additives, in recent years two new ones have been suggested: SPD (a synthetic surfactant additive) and VRP (a water-soluble polymer). SPD, a neutralized oxidate, is produced as a waste product in petrochemical synthesis and is primarily an air entraining additive. It should be used in combination with the earlier known additive SDB. VRP has a plasticizing effect in much lower doses than those required for SDB. It also has the advantage of not retarding setting. Comparative studies show that optimal dosages of these additives can produce concrete with approximately the same strength, although the combination VRP + SNV produces higher strength at certain concrete ages. Most cold resistant are concretes with SDB + SNV and SDB + SPD. The use of these additives to increase cold resistance is desirable in the manufacture of monolithic and precast structures. 3 references.

USSR

UDC 624.073.7.001.42

EXPERIENCE IN THE APPLICATION OF PRESTRESSED 18 m BOX SECTION ROOFING BEAMS

Moscow BETON I ZHELEZOBETON in Russian No. 10, Oct 76 pp 23-25

LEVITIN, A.L., GPI-5, FEDOSENKO, N.M., UkSSR Industrial Construction Ministry, ARPAKSYD, M.A., Cherkasspromstroy Combine, BURAKAS, A.I., KRIVOSHEYEV, P.I., CHEMER, A.V., VODOP'YANOV, L.V., Scientific Research Institute for Construction Structures

[Abstract] One possible means of improving the buildings used in the textile industry is the use of box section roofing beams which can also be used as ventilation and technological air lines. Scientific research and planning developments have determined the most efficient structural designs for these beams, technology for their manufacture, methods of transportation and installation. The experience gained in construction of production building No. 3 of the Cherkassk Textile Plant has confirmed the technical possibility and economic expediency of construction of buildings using box section roofing beams which serve simultaneously as air conduits. The consumption of concrete, metal and construction funds is reduced in comparison to buildings of the ordinary design. These structural elements can also be used for the construction of multistory buildings.

USSR

UDC 622.011.4:622.023

STUDY OF THE FEATURES OF WAVE FIELDS OF TRANSVERSE WAVES

Novosibirsk VOPROSY TEORII I INTERPRETATSII SEYSMICHESKIKH VOLN
[Questions in the Theory and Interpretation of Seismic Waves,
Collection of Works] in Russian, 1975 pp 228-238

LOKTSIK, V. V. and POLUBINSKIY, O. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10V846 by the authors]

[Text] The authors describe field investigations conducted on transverse waves for the purpose of studying the wave field of noises in the method of transverse waves and the anisotropy of the velocities of SV- and SH-waves. They showed that three types of wave-noises exist which form in the upper part of the cross section and exert a substantial influence on the conditions of tracking reflected waves during research on transverse waves, the greatest influence being exerted by the intensive medium-velocity wave-noises which are multiply reflected waves propagating between the day and the first stiff boundary. The authors established that on the territory of the Ural and Gur'yevsk Oblasts the Upper Cretaceous and Tertiary sediments are isotropic, however thin highly anisotropic interlayers may exist in the cross section.

USSR

UDC 622.011.4:622.023

MEASURING VELOCITY DRIFT OF ELASTIC WAVES EXCITED BY EXPLOSIONS IN THE ALMA-ATA SEISMOACTIVE REGION

Alma-Ata SEYSMICHESKIYE MIKRORAYONIROVANIYE [Seismic Microregional Division, Collection of Works] in Russian, Izd-vo Nauka, 1976 pp 137-143

ANTONENKO, A. N. and SERGEYEV, O. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10V847 by the authors]

[Text] The authors conducted field experiments using explosions for measuring the drift of velocity parameters of the medium in the epicenter zones in the process of preparing earthquakes. They developed the bases of the procedure which ensure the necessary measurement accuracy. They explain the changes in time of passage of longitudinal waves of the first arrivals based on observations carried out at intervals of 11 and 12 months. They established the increase in tectonic stresses in the region of the investigations.

USSR

UDC 624.131+539.215

TESTING INDIVIDUAL PILES WITH A SIGN-VARIABLE CYCLICAL LOAD

Moscow TRUDY. KAZAKHSKIY PROMSTROYNII PROYEKT [Works. Kazakh State Planning Institute for General-Construction and Sanitary-Engineering Planning of Individual Establishments] in Russian, No 8(18), 1976 pp 72-79

AUBAKIROV, A. T., YERZHANOV, S. YE. and ABAKANOV, M. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V786 by Yu. M. Lychko]

[Text] Reinforced concrete piles, 30 x 30 cm in cross section, were driven into macroporous loams having interlayers of sands and were tested for horizontal cyclical loading. In the course of the tests the pile was loaded with a gradually growing sign-variable load modeling the seismic load; at each step of the loading the authors measured the horizontal movements of the pile at the level where the load was applied and on the surface of the ground. From the results of the experiments, the authors established that the limiting carrying capacity of the pile is 6.5 T, the limiting horizontal movement of the upper part of the pile is 70 mm, and the limiting logarithmic attenuation decrement is 0.6 for the pile foundations with high grillage.

USSR

UDC 624.131+539.215

ON THE INFLUENCE OF THE THICKNESS OF MORAIN SEDIMENTS IN THE BASE OF STRUCTURES ON THE SEISMIC RISK OF LARGE EXPLOSIONS

Apatity MEKHANICHESKIYE EFFEKTY TEKHNOLOGICHESKIKH VZRYVOV [Mechanical Effects of Technological Explosions, Collection of Works] in Russian, 1976 pp 81-87

RITTER, F. A., MYSOV, V. P., AVENIROV, D. N., KERSHINSKIY, A. G. and ANIKIN, N. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V818 by the authors]

[Text] The authors present the results of observations of ground and building vibrations produced by massive explosions in underground mines and open pits. They demonstrated that the amplitude, cycle and duration of the vibrations depend substantially on the thickness of the Quaternary sediments in the base of the buildings to be protected. They present the empirical dependences of the amplitude of the base vibrations of buildings and ground on the given weight of the massive explosive charges.

USSR

UDC 624.131+539.215

HEAT REGIME OF SHALLOW CONDUITS IN REGIONS OF THE CHITINSK OBLAST' WITH DEEP SEASONAL FREEZING OF SOILS IN THE PERIOD OF INCOMPLETE GRID DEVELOPMENT

ZAPISKI ZABAYKAL'SKOGO FILIALA GEOGRAFICHESKOGO OBSHCHESTVA SSSR [Annals of the Transbaikal Branch of the Geographic Society of the USSR] in Russian, No 104, 1975 pp 152-166

PERELESHIN, R. S. and SEMENOV, L. P.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V748 by E. A. Bondarev]

[Text] The authors give arguments in favor of decreasing the depth of laying conduits in regions where the seasonal freezing of soils reaches 4-5 m. As proof of their arguments the authors cite the results of field observations on the soil temperature near the conduits, laid at a depth of 2.5 m with seasonal freezing of 4.5-5 m. The water temperature in the conduit was 3°. The authors also gave the procedure for an approximate determination of the heat losses of such conduits. They demonstrate that the results of the computations and measurements agree satisfactorily.

USSR

UDC 624.131+539.215

ELASTIC PROPERTIES OF FROZEN SOILS IN THE BAIKAL

ZAPISKI ZABAYKAL'SKOGO FILIALA GEOGRAFICHESKOGO OBSHCHESTVA SSSR [Annals of the Transbaikal Branch of the Geographic Society of the USSR] in Russian, No 104, 1975 pp 48-58

DZHURIK, V. I., LESHCHIKOV, F. N. and BASOV, A. D.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V749 by E. A. Bondarev]

[Text] The authors discuss the results of field and laboratory measurements of the velocities of longitudinal and transverse waves and compressive strength of frozen and thawed soils of various types. They give a brief description of the measurement procedure and apparatus used. In the laboratory tests, in addition to the type of soils, the authors varied the temperature and humidity. They showed that with lowering temperature the firmness of the soil increases continuously, whereas the velocity of the seismic waves in the temperature range from -20 to -1° remains constant. No relationship between the firmness of frozen soils and velocity of seismic waves was detected.

ON SEVERAL FEATURES OF THE OPERATION OF POSITIVE CURVATURE SHELLS SUPPORTED ALONG THE CONTOUR

Moscow TRUDY. KAZAKHSKIY PROMSTROYNIIPROYEKT [Works. Kazakh State Planning Institute for General-Construction and Sanitary-Engineering Planning of Individual Establishments] in Russian, No 8(18), 1976 pp 108-115

BAYNETOV, T. CH.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V1053 by M. I. Reytmán]

[Text] The author conducted experiments to investigate the operating features of shells supported on diaphragms which are formed by curvilinear beams. As the samples the author used models of shells 3 x 3 mm with a thickness in the middle zone of 10 mm and at the corners -- up to 40 mm. The shell was reinforced with a grid having square meshes of low-carbon steel wire, 1 mm in diameter. The curve in the curved beam was found to be analogous to the curve of the moments in the uncut beam loaded by a uniformly distributed load, whereas the axial stresses almost everywhere were tensile stresses, which agrees well with the computation. However in the operation of the shell itself the author notes a significant discrepancy between theory and experiment: the cross sections, in which the maximum bending moments were measured, remain farther from the edge than determined by computation. The major stresses in the corner zones of the shell were found to be substantially lower than the computed ones. These features must be taken into account in planning large-span shell-covers.

RESULTS OF AN ANALOG COMPUTER INVESTIGATION ON THE DYNAMICS OF A
CONSOLE COMPUTER SCHEME OF A HYDRAULIC ENGINEERING STRUCTURE

Dushanbe DINAMIKA I SEYSMOSTOYKOST' ZDANIY I SOORUZHENII [Dynamics
and Seismic Resistance of Buildings and Facilities, Collection of
Works] in Russian, Izd-vo Donish, 1976 pp 31-40

ZAYELAVSKIY, YU. L., BARYSHEVA, N. N. and ZAUROV, D. B.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10V1041 by L. Sh. Kilimnik]

[Text] The authors examine the features of using an analog computer to compute the dynamic reaction of hydraulic engineering structures, modeled by a console system. The prototype was a physical model of the Nureksnoy Hydroelectric Power Plant dam, tested under seismic explosion action. They investigated the amplitude-phase-frequency characteristics of multimass systems and reaction of the model to the perturbing signal in the form of a δ -function. They compared the discrete computation model with a continual model in the form of a symmetrical elastic wedge. They showed that the computational models with 7-8 concentrated masses give stable values of eigenfrequencies of the first 3-4 tons and agree well with the computation results for an elastic wedge. The authors mention the advantages of analog computer utilization to investigate the dynamic reaction of dams.

USSR

UDC 536.24:536.42:669-154

PROBLEM OF INTERNAL HEAT EXCHANGE IN VAPOR-LIQUID FLOWS

Minsk TEPLOMASSOOBMEN - V. MATERIALY V VSESOYUZNOY KONFERENTSII PO TEPLOMASSOOBMENU [Heat and Mass Exchange - V. Materials from the Fifth All-Union Conference on Heat and Mass Exchange, Collection of Works] in Russian, Vol 3, Part 1, 1976 pp 157-161

ZYSIN, V. A., KITANIN, E. L., LATYPOV, F. R. and IVANOV, B. YE.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B585 by Ye. S. Turilina]

[Text] The authors examine questions of effervescence of adiabatic flows of saturated liquid. The authors state that the mechanism of vapor formation is similar to the ordinary diabatic boiling of liquid, i.e., vapor bubbles are formed on the walls of the channel and tend to the center of the flow. For confirmation of such a viewpoint the authors developed essential tests on effervescence inside pipes of water, propane and freon-12 in coordinates $\alpha_{in}/\alpha = f(P_0/P_c)$, where $\alpha_{in} = rm/\pi D \bar{\theta} L$; r is the heat of vapor formation; m is the consumption of vapor; $\bar{\theta}$ is the mean difference in input temperatures to the channel and saturation temperature in the given cross section; D and L are the dimensions of the channel; P_0/P_c is the ratio of pressure at the input to the channel to the critical pressure; α is the coefficient of heat yield, determined from the generally used formulas of bubble boiling in a large volume. The results showed that $\alpha_{in}/\alpha \sim 1$. In conclusion they examine the question of bubbling of an adiabatic flow in a channel in front of a diaphragm. References 14.

USSR

UDC 532.72:669.015.23

ON THE INFLUENCE OF CURRENT TWISTING ON LOCAL HEAT AND MASS EFFICIENCY IN THE INITIAL SECTION OF A PIPE DURING A TURBULENT FLOW REGIME

Novosibirsk NEKOTORYYE ZADACHI GIDRODINAMIKI I TEPLOOBMENA [Several Questions in Hydrodynamics and Heat Exchange, Collection of Works] in Russian, 1976 pp 167-173

KHALATOV, A. A. and SHCHUKIN, V. K.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B660 by V. A. Frost]

[Text] The authors cite the results of experimental data processing on the local characteristics of heat and mass exchange in the initial section of a pipe with complete or partial twisting

of the current at the input to the pipe. They used experimental data obtained in a pipe 80 mm in diameter and up to 1000 mm in length at angles of twisting of $15 - 60^\circ$, Reynolds numbers determined from the diameter of $(1.3 - 15) \times 10^4$ and relative blasting up to 0.0013. The thermal fluxes are measured from the temperature gradient at the impermeable wall and from the heat balance in the presence of blasting. The mass efficiency was modeled by evaporation of the thin film of liquid flowing along the inner surface of the pipe. The influence of twisting is described by a complex which is linearly dependent on the ratio of the moment of the amount of motion to the product of the channel radius times the current impulse in the axial direction.

USSR

UDC 532.72:669.015.23

EXPERIMENTAL STUDY OF THE INTENSITY OF TURBULENT HEAT AND MASS TRANSPORT IN THE INITIAL SECTION OF A PIPE UNDER THE CONDITIONS WHEN THE PRANDTL NUMBER IS MUCH GREATER THAN ONE

Minsk TEPLOMASSOOBMEN - V [Heat and Mass Exchange - V, Collection of Works] in Russian, Vol 1, Part 1, 1976 pp 208-212

BORISOVA, R. D., GUKHMAN, A. A., DIL'MAN, V. V. and KADER, B. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B661 by T. M. Muratova]

[Text] The method of electrochemical modeling is used for investigation of the laws of stabilization of heat and mass transport for large Prandtl numbers. The procedure of the experiment was described in a previous work of the authors. They cite the results in the form of graphic dependences of the intensity of mass transport on the Reynolds number of a stabilized flow, the Prandtl number of the electrolyte and the length of the pipe. The test points agree well with the theoretical solution. They determine the length of the pipe necessary for stabilization of the mass transport. They define the values of the attenuation factor for intensity of the turbulent mass transport at the wall and the coefficient for the diagonal component of the tensor of turbulent diffusion. They note that by not allowing for the characteristic features of conducting such a type of electrochemical experiment a systematic error appears in determining the intensity of the mass transport.

INFLUENCE OF TURBULENCE ON HEAT YIELD ACROSS A STREAMLINING CYLINDER FOR CRITICAL Re NUMBERS

Minsk TEPLOMASSOOBMEN [Heat and Mass Exchange, Collection of Works] in Russian, Vol 1, Part 2, 1976 pp 3-12

ZHUKAUSKAS, A. A., ZHYUGZHDA, I. I. and SURVILA, V. YU.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B505 by V. M. Zaytsev]

[Text] An effective method of intensifying heat exchange is increasing the degree of turbulence of the external flow. To study the mechanism of this process in transverse streamlining of the cylinder the authors conducted experiments in currents of air and water. The tests were conducted with three degrees of turbulence (1.2, 7, and 15%) in air and with two degrees of turbulence (1, 6 - 9%) in water. The ranges of the investigated critical values of $Re = 4 \times 10^4 - 1.4 \times 10^6$, the Pr criterion was varied from 0.7 to about 0.6. It was established that the influence of turbulence on heat yield varies along the perimeter of the cylinder, reaching a maximum in the front part and a minimum in the separating zone, whereas this effect depends on the size of the Prandtl numbers Pr, and for water this dependence is more substantial than is explained by the concentration of the entire heat resistance in the stream of water at the wall itself, where the pulsations in velocity have less influence on the decrease in this resistance and therefore have less influence on heat yield. The authors note that the position of the point of onset of the transition of the laminar boundary layer to the turbulent depends on the values of Re and Tu, and the position of the point of separation of the turbulent boundary layer in the investigated interval of critical Re values does not depend on these criteria. References 12.

INFLUENCE OF COMPRESSIBILITY OF A MEDIUM ON THE THERMOCONVECTIVE PROCESSES IN A CLOSED REGION

Minsk TEPLOMASSOOBMEN [Heat and Mass Exchange, Collection of Works] in Russian, Vol 1, Part 2, 1976 pp 300-304

STANKEVICH, N. M. and PETRAZHITSKIY, G. B.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B480 by A. B. Lesin]

[Text] The authors make a numerical investigation of the influence of the criterion of compressibility $1/F = g\delta/U^2$ on the flow and transport of heat under natural convection of a compressible gas in spherical layers (δ is the thickness of the layer). The inner and outer spherical surfaces are heated uniformly, respectively, up to temperatures T_1 and T_2 under the condition $T_2 > T_1$. Solution to the stationary problem is found by the method of establishment using an explicit difference scheme in the range of measuring the criterion of compressibility $0.01 \leq 1/F \leq 0.5$.

CONVECTIVE STABILITY OF EQUILIBRIUM OF A LIQUID IN A VERTICAL CHANNEL OF TRIANGULAR CROSS SECTION

Perm' UCHENYYE ZAPISKI. PERMSKIY UNIVERSITET [Scientific Annals. Perm' University] in Russian, No 362, 1976 pp 21-27

SHAYDUROV, G. F. and YAKOVLEVA, T. G.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B494 by the authors]

[Text] The channel of the experimental model, 300 mm in length and 10.0 ± 0.1 mm in width, made of plexiglass, was filled with distilled water, equipped with 24 thermocouples and adapted for visual observations. The authors detected three types of critical convective movements and determined for them the critical Rayleigh numbers. To the lower level of instability there corresponds the two-dimensional critical movement with a nodal plane parallel to one of the faces ($Ra_a = 3450 \pm 90$). If the liquid is poured into one half of the channel and removed from the other, symmetrical to it, $Ra_b = 3850 \pm 80$ (type b movement). For the axisymmetric mode (liquid poured in the center of the channel and removed at the corners) $Ra_c = (27 \pm 1) \times 10^3$. For the channel with an infinite thermal conductivity of the walls and type b perturbations the problem of convective stability is solved by the Bubnov-Galerkin method.

INFLUENCE OF OFFSETS ON HEAT EXCHANGE DURING NATURAL CONVECTION
IN A VERTICAL LAYER

Novosibirsk NEKOTORYYE ZADACHI GIDRODINAMIKI I TEPLOOBMENA [Several Problems in Hydrodynamics and Heat Exchange, Collection of Works] in Russian, 1976 pp 23-28

IVAKIN, V. P. and KEKALOV, A. N.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B470 by Yu. M. Zhukhovitskiy]

[Text] The authors made an experimental investigation of the heat exchange in a vertical layer of 96% ethyl alcohol, 68 cm high and 6 cm wide with isothermal side walls, maintained at various constant temperatures, and heat insulated at the ends. The temperature at the points of the surface of the limiting plates and in the liquid were measured with the aid of a system of thermocouples and a thermocouple probe. Measurements of the heat yield in a highly developed turbulent regime of flow for the case of smooth vertical boundaries were made for the criterial relationship $Nu_x = 0.108 \times Ra_x^{1/3}$ which is valid also in the case of a single isothermal plate. Then a measurement was made of the heat yield in the presence on the vertical boundary of (1) a single offset with a height of $h = 2.5$ mm and width of $l = 0.5$ mm installed at a height of $x = 25.4$ cm from the base of the layer (height of the offset corresponded to twice the distance from the wall to the region of velocity maximum); (2) a single offset with dimensions of $h = 10$ mm, $l = 10$ mm installed at a height of $x = 35.7$ cm (dimensions of offset on the order of the thickness of the boundary layer); (3) regular offsets with an interval of 2 cm with dimensions of $h = 5$ mm, $l = 3$ mm, located in the central part of the layer $20.5 \text{ cm} \leq x \leq 51 \text{ cm}$. The authors give the profiles of the average temperature in several horizontal cross sections and the intensity of temperature pulsations. The presence of the offsets exerts a weak influence on the heat yield.

USSR

UDC 532.526

HEAT AND MASS EXCHANGE DURING TRANSITIONS TO A TURBULENT REGIME ON A PERMEABLE SURFACE

Minsk TEPLOMASSOOBMEN [Heat and Mass Exchange, Collection of Works] in Russian, Vol 1, Part 1, 1976 pp 98-106

YEROSHENKO, V. M., KLIMOV, A. A. and TARENT'YEV, YU. N.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B172 by V. A. Barinov]

[Text] The authors experimentally investigated the boundaries of the region of transition of a laminar boundary layer to a turbulent one under conditions of subcritical blasting. The experiments were conducted on porous (coefficient of porosity 30 - 70%, pore dimension 10 micrometers) and perforated surfaces. The rate of flow is 3 - 6 m/sec, development of perturbations in the zone of transition was determined with the aid of high-speed moving pictures (up to 4300 frames/sec) of interference patterns. As the light source they used a ruby impulse laser and a continuous-action gas laser. They blasted helium, nitrogen and other gases through the surface. They mention the features of the development of perturbations and transition in the presence of a gas blast with different molecular weight and give the Reynolds number determined at the beginning and end of the region of transition; they showed that the test data may be approximated by a power dependence on the blast parameter. On the basis of several physical hypotheses they also obtained the formulas for computing the heat exchange and mass exchange in the transition region. References 12.

INFLUENCE OF HOMOGENEOUS CONDENSATION IN A FREE STREAM ON THE INTENSITY OF A MOLECULAR BEAM

Novosibirsk NEKOTORYYE ZADACHI GIDRODINAMIKI I TEPLOOBMENA [Several Problems in Hydrodynamics and Heat Exchange, Collection of Works] in Russian, 1976 pp 106-114

SKOVORODKO, P. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B294 by V. A. Sukhev]

[Text] The author computes the free axysymmetric stream of carbon dioxide emitted from a supersonic nozzle, in one-dimensional formulation on the assumptions that the gas is non-viscous and non-heat conducting, that the liquid phase makes no contribution to the pressure and the rates of movement of the phases are identical. To describe the kinetics of condensation he uses the Frenekl-Zel'dovich theory of nucleation. In the computations he assumed that the temperature of the drop is equal to the temperature of saturation corresponding to the gas pressure. In solving the problem numerically he first found the growth in the amount of the condensate along the computation interval, and then solved the equations which describe the movement of the gas. The area of the current tube along the axis was assigned without allowing for the influence of condensation which might lead to a 10 - 30% reduction in it. In determining the intensity of the molecular beam it was assumed that all particles of the condensate have one and the same size and their distribution by velocities, just as the distribution of gas molecules, is described by an isotropic Maxwell distribution function. The results of the computation are presented in the form of a dependence of the amount of condensate, velocity ratio and average size of the condensate particles on deceleration pressure p_0 . The computation was made at a deceleration temperature $T_0 = 300^\circ\text{K}$, critical diameter of the nucleus $d = 1.91 \text{ mm}$ and with $x/d = 134$. The amount of condensate grows sharply in the vicinity of the value $p_0 = 1.3 \times 10^4 \text{ n/m}^2$ up to a quantity $q \approx 0.2$, and then grows weakly with increase in p_0 . The average size of the condensate particles has a local maximum at $p_0 = 1.3 \times 10^4 \text{ n/m}^2$, and at large values grows proportional to $p_0^{1.5}$. The intensity of the gas molecules near the value $p_0 = 1.3 \times 10^4 \text{ n/m}^2$ has a minimum. The theoretical dependence of the total intensity p_0 agrees qualitatively with the experimental one but lies below it. References 11.

USSR

UDC 532.526

INVESTIGATION OF THE HEAT EXCHANGE IN DISCONTINUOUS FLOWS WITH
LOW VALUES OF THE REYNOLDS NUMBERS

Minsk TEPLOMASSOOBMEN [Heat and Mass Exchange, Collection of
Works] in Russian, Vol 1, Part 1, 1976 pp 64-69

VASIL'YEV, A. A. and ITIN, P. G.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10B203 by V. N. Kharchenko]

[Text] The authors give the results of experimental investigations of the features of the flow and heat exchange on the flat surface near the protruding elements in the form of cylinders and offsets that are rectangular in the plane with $h/d = 20 - 0.08$ (h is the height, d is the width) when $M = 4$, $Re_{\infty} = 10^2 - 1.3 \times 10^3 \text{ cm}^{-1}$, $\bar{T}_w = 0.4$. In the tests they used thermoindicator coatings, a combined sensor (an asymptotic calorimeter with pressure receiver and permitting the thermal flux and pressure to be measured simultaneously and at the same point), visualization of the flow of an oil film with aluminum powder deposited on it. They obtained unique dependences of length and form of the zone of discontinuity on the Re for various conditions. They show the zones of the elevated thermal fluxes on the surface and obtain the correlation dependences of the maximum thermal flux at the point where the boundary layer is joined on the plate on the flow parameters and offset dimensions. With large Re these results satisfactorily agree with the known data. With decrease in the Re number the intensity of the heat exchange in the joining zone abates significantly.

USSR

UDC 662.611.2

ONE MATHEMATICAL MODEL FOR THE STUDY OF THE PROCESS OF COMBUSTION OF A STREAM
OF ATOMIZED LIQUID FUEL AS AN OBJECT OF CONTROL

Moscow TEPLOENERGETIKA in Russian No. 9, Sep 76 pp 44-46

DELYAGIN, G.N., IVANOV, Yu.V., YEVSEYEVA, S.A., Institute of Fossil Fuels

[Abstract] One of the most important features in the development of a system for control and optimization of the process of combustion is the creation of a mathematical model of the process as an object of control, establishing in

quantitative form the degree of influence of the basic mode parameters of the process on the response function, the optimization parameter which must satisfy the requirements of unambiguity, reliability and speed. A quantitative mathematical model is developed characterizing the influence of fuel consumption, excess air factor, thermal load on heat exchangers and atomized air pressure (intensity of mixing) on the variable component of the integral radiation of the flame. It is shown that the influence of mode parameters on this optimization indicator in the main zone of combustion and in the final combustion zone of the fuel differs, which agrees fully with the essence of development of the process of combustion in a stream. The mathematical model establishing the relationship of the optimization indicator and the regulated mode parameters can be expressed by a linear first power polynomial, which simplifies the problem of optimization and control of the process. 5 references.

USSR

UDC 621.86.067.001.5

RESULTS OF STUDY OF THE PROCESS OF FLUIDIZATION OF COAL DUST

Moscow TEPLOENERGETIKA in Russian No. 9, Sep 76 pp 77-80

CHAL'TSEV, M.N., NOVIKOV, A.F., ACHINOVICH, G.V., DANILENKO, A.F., Donets Polytechnical Institute -- Donbassenergo Regional Power Administration

[Abstract] An experimental study was performed of the process of fluidization of coal dust produced in ball mills, which is characterized by a broad range of particle dimensions. The experiments were performed in an installation consisting of a glass pipe with an inside diameter of 140 mm and a height of 2 m, an air chamber and a horizontal gas distributing grate of fine wool felt 10 mm thick. One peculiarity of the fluidization of coal dust is the presence of a pressure peak upon initial breakthrough of the air jet through the compact layer. The transition of the layer to the fluidized state occurs over a broad range of air flow velocities; reverse transition to the immobile state also occurs over a rather broad range of velocities. These zones characterize the instability of the properties of the layer. The properties of the layer stabilize with full fluidization; therefore, it is recommended that the air flow rate be initially high, then decreased after stabilization occurs. The formulas presented can be used for approximate determination of the parameters of fluidization of coal dust with varying grain characteristics. Additional studies of the process of fluidization using various types of coal, each with its characteristic fractional composition, would be required for the production of universal calculation formulas. 5 references.

EXPERIMENTAL AND THEORETICAL INVESTIGATION OF HEAT EXCHANGE UPON EVAPORATION OF A LIQUID IN A DRAINING FILM

Minsk TEPLOMASSOOBMEN - V [Heat and Mass Exchange -V, Collection of Works] in Russian, Vol 4, 1976 pp 9-17

TAUBMAN, YE. I. and KALISHEVICH, YU. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B693 by A. I. Ivandayev]

[Text] The authors report on the results of a theoretical and experimental investigation of the process of heat exchange upon evaporation of draining films of liquid. Theoretical analysis is done on the assumption of an absence of influence on the heat exchange by the vapor bubbles forming on the heating surface: it is assumed that the evaporation takes place only from the film surface. They find a relationship which permits determining the coefficient of heat yield as a function of the regime and structure parameters of the film apparatus, in particular on the value of the temperature pressure. The process of evaporation of the draining film was studied experimentally: (1) on a flat surface of 1Kh18N9T steel with a width of 165 mm and a height of 1000 mm at atmospheric pressure (visually); (2) on a test device, whose working segment was a steel pipe with a diameter of 40/34 and a height of 6 m. The tests were conducted on a distillate, tap and sea water in the following ranges of regime parameters: vapor pressure in the pipe $p_1 = 0.1 - 0.2$ MPa, $p_2 = 0.06 - 0.1$ MPa, density of reflux $\Gamma_0 = 0.3 - 3.0$ kg/(m·sec), density of thermal flux $q = 10 - 80$ kW/m², useful temperature pressure $\Delta T_2 = 2 - 10^\circ\text{K}$. It was established that in the investigated range of thermal fluxes and densities of reflux, as a rule, there is an intense evaporation from the film surface. The coefficient of heat yield is basically influenced by the temperature pressure, the density of reflux and the length of the heating surface. Based on the results of the experimental data processing the authors constructed an empirical approximation dependence for the coefficient of heat yield $\alpha_2 = 13,500 (\Delta T_2)^{-0.6} \Gamma_0^{0.22}$. The theory and experiment are compared and a satisfactory agreement is observed. References 12.

MOVEMENT OF STRATA DURING AN EXPLOSION ON A PACKING MEDIUM

Apatity MEKHANICHESKIYE EFFEKTY TEKHNOLOGICHESKIKH VZRYVOV [Mechanical Effects of Technological Explosions, Collection of Works] in Russian, 1976 pp 44-50

KORNEV, G. N., DEMIDOV, YU. V. and POGREBNYAK, O. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V873 by the authors]

[Text] The authors describe the procedure and results of registration under industrial conditions of the shift of strata in the process of briefly retarded strata explosion. They established that with specific consumption of the explosive for 0.25 kg/T repulsion, the shift in boundary of the "gripping medium - massif" is 0.8 m for a maximum velocity of strata movement of 5.8-6.6 m/sec. By the moment of the explosion of each subsequent stratum, the gap between them and the previous stratum is 6-8 cm; the time between the moment of arrival of the seismic wave and the beginning of shift of the entire stratum is 16.5 msec for the stratum in the gripping medium and 6.5-6.8 msec for the subsequent strata.

USSR

UDC 621.191.8-192.001.5.002.235

DETERMINATION AND ELIMINATION OF THE CAUSES OF DAMAGE TO THE BAFFLE
SUPERHEATERS OF STRAIGHT-THROUGH BOILERS

Moscow ELEKTRICHESKIYE STANTSII in Russian No 3, Mar 76 pp 12-15

DASHKIYEV, YU. G., PODOBED, O. P., POLUPAN, G. P., and GOLOSENKO, I. I.,
Kiev Polytechnic Institute and the Krivorozhskaya GRES

[Abstract] Cracks formed in the 12Cr1MoV and Cr18Ni12Ti steel tubes in the first-stage superheaters in the first 3-4 months after installation or repair. The damage was only in the tube bundles directly behind the spray coolers. The thermal load on the tubes was 35.5 kW/m and the temperature varied from 0.58-1.24 about the average along the tube. The damage was caused by corrosion from iron oxide deposits on the outside of the tube walls. The iron oxides came from deposits that accumulated in the spray tubes during down times for repairs. Thorough acid cleaning of the spray tubes eliminated the damage. Figures 5; references: 2 Russian.

USSR

IMPROVING THE SEAL IN TURBINE INSTALLATION VACUUM SYSTEMS

Moscow ELEKTRICHESKIYE STANSII in Russian No 3, Mar 76 pp 30-32

SHNYAKIN, A. V., and SHCHAVLEV, V. I., Central Asian Division of the State Trust for the Organization and Rationalization of Regional Electric Power Plants and Networks, and the Angrenskaya Hydroelectric Power Station

[Abstract] Installing a gate valve in the piping to remove steam from the intermediate gland chambers for the seventh-stage high-pressure cylinder, adding tubing to provide additional steam to the rear gland on the generator side of the low-pressure cylinder, and changing the diameter of the limiting washers in the lines to remove the air-stream mixture reduced the suction of air in the vacuum system to 10-11 kg/hr and made it possible to hold the pressures in gland-steam and suction collectors to their optimum values of 1.13-1.14 and 0.88-0.89 kg/cm², respectively. Figures 4; references: 4 Russian.

USSR

PRECIPITATION OF NIOBIUM AND ZIRCONIUM CARBIDES FROM A THREE-REAGENT VAPOR-GAS MIXTURE

Kiev VYSOKOTEMPERATURNYYE KARBIDY (Refractory Carbides -- Collection of Works) in Russian 1975 pp 19-28

GORDA, V.P., KUZNETSOV, Ye.A.

[Abstract] Results are presented from experimental study of the processes of precipitation of zirconium and niobium carbide from a mixture of the corresponding metal chloride, methane, hydrogen and helium. The studies were performed on an installation consisting of the operating section, dosing device and control panel. The operating section consists of a water-cooled chamber within which is a graphite tube 8 mm in diameter and 350 mm in length. The tube is heated by resistance to electricity. The regularities of formation of the zirconium and niobium carbides from the three-reagent vapor-gas mixture in the apparatus are studied. Microscopic examinations of the carbides are used to determine the optimal conditions of formation, producing precipitates of high quality: homogeneous, compact, fine-crystalline structures. The kinetics of the process of precipitation of carbides are studied, the order of the reactions with respect to the reagents in the system is determined, as well as the temperature dependence of the true precipitation rate constants in the 1100-1600 C interval. The equality of activation energy in the two processes indicates the identical nature of the limiting stage of precipitation of both carbides. 12 references.

USSR

STABILITY OF CONGRUENT EVAPORATION OF PHASES OF VARIABLE COMPOSITION

Kiev VYSOKOTEMPERATURNYYE KARBIDY (Refractory Carbides -- Collection of Works) in Russian 1975 pp 51-58

NIKOL'SKAYA, T.A., AVARBE, R.G.

[Abstract] The concept of stability of congruent evaporation is introduced, meaning the possibility of achieving a congruently evaporating composition by direct evaporation from an open surface in a vacuum of any initial alloy composition. A criterion is suggested for estimation of the stability of congruent evaporation of a multicomponent system. It is shown that the congruent evaporation of binary carbide alloys of transition metals of groups IV-V is always stable, of ternary alloys (such as Me'-Me''-C) is unstable. 6 references.

USSR

UDC 621.311.016.2:658.155.4.001.24

RATIONAL UTILIZATION OF THE OPERATING POWER RESERVE IN ELECTRIC POWER SYSTEMS

Moscow ELEKTRICHESKIYE STANTSII in Russian No 3, Mar 76 pp 39-42

DUBITSKIY, M. A., and CHEL'TSOV, M. B., Siberian Power Institute, Siberian Department of the Academy of Sciences USSR

[Abstract] The required on-line reserve power $R(t)$ is divided into terms which can be determined a priori and a statistical term $r(t)$, which is determined from daily or weekly fluctuations. Regression on $r(t)$ produces a deterministic term $\tilde{r}(t)$ and a normally random term $r^*(t)$. The normal distribution curve produces a probability $P(r^*(t))$, which is the system reliability. If the required reliability is given the required on-line reserve power can then be determined. Figures 2; references: 10 Russian.

USSR

UDC 532.516

FORMULATION OF THE ASSOCIATED PROBLEM OF THE FLOW OF A NEWTONIAN LIQUID IN A GAP

Sverdlovsk VOPROSY MEKHANIKI POLIMEROV I SISTEM [Questions in the Mechanics of Polymers and Systems, Collection of Works] in Russian, 1976 pp 65-72

POZDEYEV, A. A., TSAPLINA, G. S. and TSAPLIN, A. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B69 by the authors]

[Text] The authors examine a plane stationary flow of an incompressible Newtonian liquid in the gap between a movable plate with a flange and a fixed smooth plate under the condition of complete adhesion at the boundary. The fields of velocities and pressures are determined from the solution to the variation problem at the conventional extremum for which the Euler-Lagrange equations are the equations of incompressibility and equilibrium. The finite-difference solution to the energy equation, by allowing for dissipation under third-order boundary conditions, allows determining the temperature field. The associated problem is solved by the method of successive approximations. A numerical solution is found for one specific problem which is compared with the analytical one. References 6.

USSR

UDC 532.529

DETERMINATION OF THE COEFFICIENTS OF HYDRAULIC RESISTANCE AND TRUE GAS CONTENT DURING MOVEMENT OF VAPOR-LIQUID MIXTURES IN TRANSFER CONDUITS

TRUDY BASHKIR NII PO PERERABOTKE NEFTI [Works of Bashkir Scientific Research Institute on Petroleum Processing] in Russian, No 14, 1975 pp 70-79

KHUDAYDATOVA, L. B.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B805 by A. I. Ivandayev]

[Text] The author reports about the results of experiments on determining the coefficients of hydraulic resistance and true gas content during the movement of air-water mixtures through brass pipes with a diameter of 18 mm, having different configurations: horizontal, Z-shaped with an angle of turn of 90° in the vertical plane, S-shaped with an angle of slope of 60, 70 and 80° to the horizon. The tests were conducted in series at fixed rates of flow of the mixture, corresponding to values of the Froude criterion of $Fr = 280, 640, 1125, 1830$ and 2670 at a constant pressure of 4 absolute atmospheres in the range of expenditure gas contents of $0.9980 - 1.0$. By processing the results the author finds the two-parameter empirical dependences for determining the coefficient of hydraulic resistance and true gas content as a function of the Froude number and the expenditure gas content of the mixture. References 6.

USSR

UDC 536.24

INVESTIGATION OF RADIATION-CONVECTIVE HEAT EXCHANGE WITH A TURBULENT STREAM OF GAS SUSPENSION

Minsk TEPLOMASSOOBMEN - V. MATERIAL V VSESOYUZNOY KONFERENTSII PO TEPLOMASSOOBMENU [Heat and Mass Exchange - V. Materials from the Fifth All-Union Conference on Heat and Mass Exchange, Collection of Works] in Russian, Vol 6, 1976 pp 218-227

SPOTOYNNYY, F. YE., GORBIS, Z. R., SVYATETSKIY, N. V. and ZAGAYNOVA, R. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B509 by V. P. Lukash]

[Text] The authors examine the hydrodynamically stabilized axisymmetric flow of a gas suspension in a cylindrical channel with

a small concentration of solid particles ($\mu \leq 1.0$). It is assumed that the gas is transparent, the wall of the channel radiates and absorbs in a diffuse manner, the particles are sulfur of an absorbing and scattering disperse medium, the intensity of the thermal flux on the wall q_w is constant. Analysis of the problem is done on the assumption of a lack or presence of longitudinal overflows of heat. They cite computational data on the distribution of temperature and the Nusselt number along the length of the channel with different values of the Bouguer criterion, temperature of the current at the input, concentration of solid particles. They obtain test data for use for nickel particle dust content of the air. The experiments were conducted at $q_w \leq 50 \text{ kW/m}^2$, $Re = (1 - 2) \times 10^4$, $T_w \leq 1150^\circ\text{K}$. It was shown particularly that with increase in wall temperature $\mu = \text{const}$ the Nusselt number grows which is due to the amplification of the radiation transport of heat. References 15.

Marine and Shipbuilding

USSR

UDC 629.12.06

REDUCTION OF THE NOISE OF EXHAUST SYSTEMS

Leningrad SUDOSTROYENIYE in Russian No. 7, Jul 76 pp 30-31

TARASOV, V.I.

[Abstract] The use of standard mufflers in ship engine design is not desirable due to space limitations. Noise can be reduced by allowing the sound to propagate from a channel of small diameter into a channel of much larger diameter, then back into a channel of smaller diameter. Formulas are given for calculation of the diameters and spacings of apertures in diaphragms to be used for this purpose. Formulas and a table are presented for calculation of the noise level of steam exhaust when this principle is used. 6 references.

USSR

UDC 621.431.74-185:621.436

A POWERFUL LOW-SPEED DIESEL ENGINE FOR A 100,000 TON TANKER

Leningrad SUDOSTROYENIYE in Russian No. 7, Jul 76 pp 32-35

MARKOV, A.Ya.

[Abstract] A photograph, description and characteristics are presented for the main motor of a new 258.2 m LOA, 39.8 m beam, 14.5 m draft, 100,000 ton Soviet Supertanker. The automated diesel power plant is served underway by one man at a central control panel. Characteristics are as follows: long-term power output 21,100 h.p.; maximum 1-2 day power output 23,200 h.p.; maximum one-hour power output 25,500 h.p., rotating speeds at these power ratings 110, 114 and 117 rpm; cylinder bore 840 mm; stroke 1800 mm; nine cylinders; fuel consumption not over 154 g/h.p.·hr; weight about 762 tons; operating life to overhaul 100,000 hours; to cylinder lining replacement 40,000 hours; between disassemblies (for piston reworking) 6000 hr.

USSR

UDC 629.124.791.2.03-843.8

STUDY OF THE DYNAMICS OF A GAS TURBINE INSTALLATION AS A SHIP TRAVELS THROUGH ICE

Leningrad SUDOSTROYENIYE in Russian No. 7, Jul 76 pp 36-38

YUDOVIN, B.S., GOTE'MAN, A.I.

[Abstract] A study is made of the dynamic characteristics of a gas turbine installation from the standpoint of its suitability for the loads characteristic

for ice conditions. The significant increase in power and economy of gas turbines with decreasing air temperature makes them quite promising for use in the higher latitudes where ice is likely to be encountered. The reactions of a gas turbine installation to the typical variations in load on the screws of a ship as it moves through ice were studied for the most common types of gas turbine engines. It was found that, contrary to earlier beliefs, the dynamic characteristics of gas turbine engines are quite suitable for travel through ice, even considering the initial data used in the study, corresponding to the most severe modes of operation likely to be encountered. 6 references.

USSR

UDC 621.431.74.018.7

APPROXIMATE ESTIMATE OF THE PICKUP OF A SHIP'S MAIN ENGINE AND OF ITS INERTIAL PROPERTIES

Leningrad SUDOSTROYENIYE in Russian No 8, Aug 76 pp 27-29

GLUSHKOV, S.P., and POTYAYEV, V.A.

[Abstract] In designing a power plant and a remote system for automatically controlling it, it is important to make an early estimate of the optimum running conditions of the engines and to have a sufficient idea of the influence of the engines' acceleration characteristic on the maneuvering properties of the ship as a whole. The engine's acceleration characteristic is determined by three factors: The dynamic properties of the engine itself, the fuel supply process determined by the control system, and the nature and degree of the mutual influence of the ship's hull on the engine's power generation process (in interlocked gas turbine and diesel power plants). The hull's inertia influences the engine's acceleration, reducing its propulsion. Dynamics equations are used to obtain a universal formula for a dimensionless estimate of the dynamic relationship between the input and output coordinates of the accelerating component, making it possible to make an estimate of the pickup of the main engines and of the acceleration characteristic of the ship, the formula being equally applicable to both the engine and the ship's hull. An approximate equation is obtained for optimum running conditions, making it possible to form a basis for compiling comparative statistics for the maneuverability of ships of different types. Universality of these dimensionless factors is ensured by the fact that the time constants of all the components of the ship-propellor-engine-control system complex take into account all the particular characteristics of these components. Figures 3; references 4: 4 Russian.

USSR

UDC 621.186.4

METHODS OF SOLVING THE PROBLEM OF INCREASING THE LIFETIME OF ACTUAL AND PROJECTED STEAM LINES ABOVE 100,000 HOURS

Moscow TEPLOENERGETIKA in Russian No 10, 1976 pp 6-8

ADAMOVICH, V. K., Candidate of Engineering, Central Boiler Tube Institute

[Abstract] Published methods of projecting and extending the lifetime of steam lines are reviewed. Curves of the lifetime τ versus the applied stress σ are straight lines in coordinates of $\log \sigma$ versus $(\log \tau)^{1.5}$. Curves of τ versus the operating temperature T are straight lines in coordinates of $\log \tau$ versus $1/T$ for a given σ . For 21CrMoW511 steel, lifetime $\tau = 10^3$ and 10^5 hr were found for $\sigma = 3.0$ and 0.7 MPa at $T = 823^\circ\text{K}$; at $T = 873^\circ\text{K}$, $\tau = 10^2$ and 10^4 hr at the same σ 's. Lifetimes of $\tau > 10^5$ were found for 12MoCr, 15CrMo, and 12Cr1MoV steels for $\sigma = 0.9$ – 1.5 , 0.7 – 1.2 , and 0.7 MPa at $T = 510$, 540 , and 565°K , respectively. The rupture strength of the steel is improved and τ can be doubled to $2 \cdot 10^5$ hr by keeping the plasticity $>1\%$ by holding the sulfur and phosphorus to $\leq 0.02\%$ and by increasing the wall thickness by 5–20%. Figures 4; References: 14 Russian.

USSR

UDC 669.14.018.85

HEAT-RESISTANT PROPERTIES OF 15CrMo STEEL AFTER ITS DESIGN SERVICE LIFE

Moscow TEPLOENERGETIKA in Russian No 10, 1976 pp 12-16

LEVITSKIY, YU. V., Donets Division of the State Trust for the Organization and Rationalization of Regional Electric Power Plants and Networks

[Abstract] The elongation at failure δ (percent) and the creep rate V (%/hr) were measured on sections of 15CrMo steel that had been stressed at 0.43 MPa in a 10 MPa steam line at 510° for $106,000$ hr. The results could be fit by empirical formulas: $\log_e(V) = 85.8 + \log_e(\sigma^3/T^2) - (77,477 - 289\sigma)/T$, $\log_e(\delta) = 12.9 - \log_e(\sigma) + (12,444 - 50\sigma)/T$, where T is the temperature ($^\circ\text{K}$) and σ is the stress (Pa). The corresponding relationship for the service life τ (hr) is $\log_e(\tau) = (65,033 - 239\sigma)/T - 72.9 + \log_e(T^2/\sigma^3)$. Figures 3; References: 11 Russian.

USSR

UDC 539.385

INCREASING THE RESISTANCE TO FATIGUE FRACTURE OF A ZHS6U ALLOY

Kuybyshev MEKHANIKA [Mechanics, Collection of Works] in Russian, No 9, 1976 pp 73-74

KOSTINA, G. N.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V1213 by L. M. Shkol'nik]

[Text] For the purpose of increasing fatigue strength of parts made of a ZhS6U alloy the author recommends using the method of thermoplastic strengthening in combination with aluminizing. Thermoplastic strengthening is accomplished at 700° and pressure of 6 technical atmospheres. The fatigue strength was determined at a temperature of 900°. With increase in the test base, the relative increase in fatigue limit is increased.

USSR

UDC 539.4:536.543

INFLUENCE OF PRELIMINARY STRAIN ON CREEP AND INTERNAL FRICTION OF NICKEL

Voronezh IZVESTIYA VORONEZHSKOGO GOSUDARSTVENNOGO PEDAGOGICHESKOGO INSTITUTA [News of the Voronezh State Teachers Institute] in Russian, No 151, 1976 pp 13-18

ZUBEKHIN, V. P. and POPOV, V. I.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V1227 by I. M. Gryaznov]

[Text] Samples of NP-2 nickel in the form of wires were preliminarily subjected to cold tensile working and annealing and then tested for tensile creep at 650°. It was shown that 3% cold working doubles the lifetime of the sample and decreases the internal friction. This is due to its lighter substructure which makes movement of the dislocations difficult. The conclusion is made that the lower the internal friction of nickel, measured in the creep process, the greater is its lifetime and the lower the creep rate.

USSR

UDC 621.315.592:539.23+548.55

CALCULATION OF RATES OF GROWTH AND ETCHING OF SILICON IN THE SILICON-CHLORINE-HYDROGEN SYSTEM

Novosibirsk PROTSESSY ROSTA I SINTEZA POLUPROVODNIKOVYKH KRISTALLOV I PLENOK (Processes of Growth and Synthesis of Semiconducting Crystals and Films -- Collection of Articles) in Russian 1975 pp 90-94

NIKOLAYEVA, V.V., SKVORTSOV, I.M.

[Abstract] An attempt is made to reconcile the disagreement between experimental and calculated data on the rates of growth and etching of silicon in the silicon-chlorine-hydrogen system and determine which factor makes the greatest contribution to this variation. This is done using data obtained by experimental modeling of the growth-etching equilibrium for $\text{SiCl}_4\text{-HCl-H}_2\text{O}$ mixtures at $m=0.001, 0.0021, 0.0042, 0.0084$ and 0.02 (where m is the molar SiCl_4/H_2 ratio). The experiments were performed on a horizontal type installation with a quartz water-cooled reactor. The results indicate that zero growth rates are achieved with significant supersaturations of silicon in the gas phase. It is concluded that in a flow-through reactor quasi-equilibrium always occurs where $\text{Si/Cl}_{\text{in}} > \text{Si/Cl}_{\text{eq}}$, because under conditions of thermodynamic equilibrium, silicon-containing compounds are formed on the surface of the silicon substrate, which are not present in the vapor-gas mixture fed into the reactor. With quasi-equilibrium conditions on the surface of the substrate there is a balance of silicon atoms: the flux of silicon delivered by silicon chloride is equal to the flux of silicon carried away by silicon dichloride, but the composition of the gas mixture on the surface of the substrate is near the thermodynamically equilibrium concentration. The results of calculation of relationships between rates of growth and etching considering differences in the values of the transport terms as calculated in this article are presented. 6 references.

USSR

UDC 621.315.592:539.23+548.55

STUDY OF THERMODYNAMIC CONDITIONS OF GROWTH OF EPITAXIAL GALLIUM ARSENIDE FILMS IN THE SYSTEM $\text{GaAs-H}_2\text{O-H}_2$

Novosibirsk PROTSESSY ROSTA I SINTEZA POLUPROVODNIKOVYKH KRISTALLOV I PLENOK (Processes of Growth and Synthesis of Semiconducting Crystals and Films -- Collection of Articles) in Russian 1975 pp 98-103

BARYBIN, A.A., ZAKHAROV, A.A., NEDEV, N.K.

[Abstract] A thermodynamic calculation is presented of the stoichiometric composition of the gas phase in the system $\text{GaAs-H}_2\text{O-H}_2$. The results are used to determine the conditions of occurrence of competing chemical reactions with the formation of Ga(l) and $\text{Ga}_2\text{O}_3\text{(s)}$, which disrupt the stoichiometry of the

gas composition. Calculation of the gas phase considering the competing reactions allows the area of stoichiometry to be selected, as well as the optimal conditions for conduct of the epitaxial process. 19 references

USSR

UDC 621.315.592:539.23+548.55

STUDY OF THE PROCESS OF PRODUCTION OF GALLIUM ARSENIDE CRYSTALS IN THE SYSTEM GaAs-Br₂

Novosibirsk PROTSESSY ROSTA I SINTEZA POLUPROVODNIKOVYKH KRISTALLOV I PLENOK (Processes of Growth and Synthesis of Semiconducting Crystals and Films -- Collection of Articles) in Russian 1975 pp 109-112

DRONYUK, M.I., SHCHERBAY, K.S., VARSHAVA, S.S.

[Abstract] This work presents the first study of the conditions of crystallization of GaAs in a bromide system and the production of crystals of gallium arsenide. An experimental study of equilibrium in the system GaAs-Br₂ is conducted. The temperature dependence of pressure is studied by a static method using a quartz manometer in the 300-1233 K temperature range. It is found that bromine interacts intensively with GaAs at room temperature without the formation of gaseous compounds. However, the reaction products are quite volatile at temperatures over 200 C. 8 references.

USSR

UDC 621.315.592:539.23+548.55

EXPERIMENTAL STUDY OF THE CONDITIONS OF HETEROEPITAXIAL GROWTH OF FILMS OF GALLIUM ARSENIDE ON DIELECTRIC SUBSTRATES

Novosibirsk PROTSESSY ROSTA I SINTEZA POLUPROVODNIKOVYKH KRISTALLOV I PLENOK (Processes of Growth and Synthesis of Semiconducting Crystals and Films -- Collection of Articles) in Russian 1975 pp 163-166

BARYBIN, A.A., ZAKHAROV, A.A., LIKHOLETOV, Yu. V., NEDEV, N.K.

[Abstract] Results are presented from an experimental study of the conditions of heteroepitaxial growth of films of gallium arsenide by chemical transport of GaAs by water vapor in a sandwich system. The studies performed showed that at substrate temperatures of from 650 to 900 C with source-substrate temperature differences of 10 to 60 C, a continuous layer of gallium arsenide generally does not grow on the substrate surface. Apparently the seed formation rate is slight at these temperatures and coalescence does not fully occur. Production of a continuous layer requires higher saturations in the system, achieved by increasing the temperature gradient between substrate and source.

The best films were produced on substrates of sapphire and garnet at 650-750 C with a source-substrate temperature difference of 70-120 C. The growth rate was 0.5-1.2 $\mu\text{m}/\text{min}$. 13 references.

USSR

UDC 621.315.592:539.23+548.55

EPITAXIAL FILMS OF ZINC OXIDE ON SAPPHIRE AND OTHER SUBSTRATES

Novosibirsk PROTSSESSY ROSTA I SINTEZA POLUPROVODNIKOVYKH KRISTALLOV I PLENOK (Processes of Growth and Synthesis of Semiconducting Crystals and Films -- Collection of Articles) in Russian 1975 pp 188-194

BAGAMADOVA, A.M., SEMILETOV, S.A., RABADANOV, R.A.

[Abstract] A study was made of zinc oxide films produced by chemical transport on substrates of sheet mica, sapphire, as well as plates of germanium and gallium arsenide. The studies showed that on the faces of mica, Ge and GaAs, film growth is quite similar. It begins with the formation of discrete seeds, which coagulate and grow together to form a highly defective thin continuous layer. Subsequently, new crystals develop on the surface of this layer with precise crystallographic delineation, forming at the points where three crystals of the previous layer grew together. The growth of the next layer begins after the entire surface is filled with the previous layer. Analysis of the other substrates confirms that the morphology of the film surface produced under optimal growth conditions is a characteristic of the substrate surface, while the peculiarities of morphology depend directly on deposition conditions. 2 references.

USSR

THEORETICAL ANALYSIS OF THE PROCESS OF HOMOGENIZATION OF DISPERSED MIXTURES IN THE PSEUDOBINARY SYSTEM TiC-ZrC UPON SINTERING AND HOT PRESSING

Kiev VYSOKOTEMPERATURNYYE KARBIDY (Refractory Carbides -- Collection of Works) in Russian 1975 pp 100-111

OGORODNIKOV, V.V., SVERDLIK, N.N.

[Abstract] A theoretical analysis is presented of the process of homogenization in the dispersed system titanium carbide-zirconium carbide. Existing methods of calculation of the distribution of the alloys by concentration

are reanalyzed on the basis of the face-centered cubic model and a simpler method is suggested, based on the introduction of the approximation of a flat diffusion front in each elementary volume. An analysis is presented of the process of homogenization of the mixtures with changing concentration distributions, fraction of the alloy with an assigned concentration, Fischer homogeneity criterion, maximum and minimum concentrations in the alloy. Theoretical and experimental data are compared. 8 references.

USSR

THE INTERACTION OF POWDERS OF SILICON AND NIOBIUM CARBIDE

Kiev VYSOKOTEMPERATURNYYE KARBIDY (Refractory Carbides -- Collection of Works) in Russian 1975 pp 135-139

KUTYSHEVA, E.V., KUZ'MA, Yu.B.

[Abstract] A study is made of the interaction of the carbide $\text{NbC}_{0.98}$ with silicon in a vacuum of 10^{-2} mmHg in the 900-1900 C temperature interval. The specific surface of the powders of the initial carbide and silicon were 0.2 and 4.75 m^2/g , corresponding to a mean particle diameter of 15 μm . The results of the experiments studying the influence of temperature on interaction products show that the interaction begins at 1100 C, but its rate at this temperature is very low. As the temperature rises, the reaction rate increases, and at 1500 C with a holding time of 60 minutes the silicon interacts completely with the carbide. At over 1500 C, the rate of evaporation of the silicon begins to prevail over the reaction rate and the quantity of reacted carbide decreases. The reaction products throughout the temperature interval are niobium disilicide and the beta modification of silicon carbide. The results of the experiments are evaluated on the basis of data from x-ray and chemical phase analyses. 4 references.

USSR

THE PROBLEM OF THE NATURE OF EVAPORATION OF TRINARY SOLID SOLUTIONS IN A VACUUM

Kiev VYSOKOTEMPERATURNYYE KARBIDY (Refractory Carbides -- Collection of Works) in Russian 1975 pp 58-64

NIKOL'SKAYA, T.A., AVERBE, R.G.

[Abstract] A study is made of the conditions of congruent evaporation from an open surface in a vacuum of trinary hard alloys of two types: metal (1)-metal (2)-nonmetal ($Me'-Me''-X$) and metal-nonmetal (1)-nonmetal (2) ($Me-X'-X''$). It is shown that congruent evaporation of the $Me-X'-X''$ system is improbable. A simple criterion is suggested for estimating the possibility of congruent evaporation of $Me'-Me''-C$ systems. Based on this criterion, the possibility is estimated for 15 trinary carbides of Ti, Zr, Hf, V, Nb and Ta. It is shown that only the system Nb-Hf-C is of interest in this respect. 4 references.

USSR

STUDY OF ALLOYS IN THE TRINARY SYSTEM HAFNIUM-MOLYBDENUM-CARBON

Kiev VYSOKOTEMPERATURNYYE KARBIDY (Refractory Carbides -- Collection of Works) in Russian 1975 pp 90-99

YEREMENKO, V.N., VELIKANOVA, T.Ya., SHABANOVA, S.V.

[Abstract] A study is made of the structure of alloys in the system hafnium-molybdenum-carbon in the area of high temperatures from 2000 C to the temperature at which melting begins. It is shown that near the solidus surface in the system there is a continuous series of hard alloys (Mo, Hf) C_{1-x} . In the solid state, all phases in the system Mo-Hf-C enter into equilibrium with solid solutions (Mo, Hf) C_{1-x} . Strong relative enrichment of the carbide phase with hafnium is observed in this case. 6 references.

USSR

UDC 621.746.75:669.15.018.25:539.3

EFFECT OF NONMETALIC IMPURITIES ON THE FATIGUE STRENGTH OF 40KhNML STEEL

Kiev TEKHNLOGIYA I ORGANIZATSIYA PROIZVODSTVO in Russian No 8, 1976
pp 37-39

PRIMEROV, S. N., engineer, Institute of Casting Problems, Academy of Sciences USSR, Kiev

[Abstract] Three variants of 40KhNML steel were reduced at 880°C with additions of 0.1% aluminum, 0.3% ferrotitanium, and an inoculant of either 0.15% silicocalcium [SC], 0.1% ferrocerium [FC] or 0.3% of a compound inoculant [CI] which consisted of calcium, magnesium, and cerium. The steel samples were quenched in oil from 860°C and then tempered in two stages at 500°C for 2 hours and at 580°C for 55 minutes. The samples had a structural hardness of 95-100 kg/mm² and an HRC of 37-39. The structure of the samples was a fine dispersion of perlite. The total oxide impurities in the SC, FC, and CI variants was 0.03, 0.02, and 0.02%. The fatigue strengths, which were measured at 600-650 Hz for 10⁷ cycles were 29, 32, and 38 kg/mm². The relative dispersions of the dendrite structure were 27, 40, and 45. Use of the CI also increases the fractions of silicon, iron, and manganese oxides in the oxide impurities and decreases the fraction of alumina.

USSR

UDC 621.762

AVIATION ENGINE PISTON RINGS FROM AN IRON-BASED SINTERED MATERIAL

Kiev TEKHNLOGIYA I ORGANIZATSIYA PROIZVODSTVO in Russian No 8, 1976
pp 67-68

CHERNYAVSKAYA, S. G., Candidate of Engineering, and KHOROSHILOV, A. YA., SENOTRUSOV, S. K., VAKS, L. S., and STRIZHAK, A. V., engineers, Dnepropetrovsk State University

[Abstract] An experimental aviation engine piston ring material was prepared from a mixture of powders (1.8-3.0% C, 2.5-3.0% Cr, 1.5% Cu, and the rest Fe). The powder mixture was pressed at 5-6 ton/cm² to a relative density of 85-88% and then sintered at 1,290-1,320°C for 2.5-3.0 minutes. The resultant material has an HRB hardness of 85-95, an elastic modulus $E = 10,000-12,000$ kg/mm², a bending strength of 50-70 kg/mm², and a residual strain of 10%. It has a thin-layered microstructure with solid inclusions. The material can be machined with normal equipment, but at reduced rates. The parts are thermally stabilized for 3 hours at 510±20°C. An engine operated with the rings operated normally; no wear was observed on the rings after the test run. Use of this material would halve the number of operations and reduce manufacturing labor and heavy metal consumption.

STRENGTH AND DEFORMATIVE PROPERTIES OF SPECIAL SAND CONCRETE

Moscow SBORNIK ZHELEZNOBETONNOY KONSTRUKTSII IZ VYSOKOPROCHNOGO BETONA [Collection of Reinforced Concrete Construction of High-Strength Concrete, Collection of Works] in Russian, Izd-vo Stroyizdat, 1976 pp 43-51

BELIKOV, V. A. and RUSANOVA, L. P.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V1298 by O. M. Popkova]

[Text] The authors describe the procedure and results of an experimental study of the strength and deformative properties of high-strength sand concrete relative to water-impermeable concrete blocks of a tunnel lining. They tested samples prepared from a concrete mixture with a composition of 1:1.61:0.23 (C:S:HSC) on type 600 Portland cement. The concrete mixture was packed by the method of force pressing. Samples were cut from the tunnel lining along and across the blocks. The authors cite values of the cubic and prism strength of the concrete, the relationships between prism and cubic tensile strength. The obtained character of the change in the coefficient of transverse compressive strain of the concrete indicates the practically elastic operation of the concrete under a load all the way to fracture. The authors mention that the shrinkage of the investigated concrete significantly exceeds the shrinkage of ordinary high-strength concrete. The conclusion is made that the reduced plastic properties of the investigated concrete in conjunction with the significant shrinkage strains require a special justification for its usage in off-center compressed and flexible elements.

ON THE TEMPERATURE DEPENDENCE OF INTERNAL STRESSES IN FILMS USING AN EXAMPLE OF BERYLLIUM BRONZE CONDENSATES

Novosibirsk VYCHISLITEL'NYYE SISTEMY [Computer Systems, Collection of Works] in Russian, No 66, 1976 pp 123-128

BELEYCHEVA, T. G.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V1339 by the author]

[Text] The author made a radiographic investigation of the dependence of macrostresses σ on condensation temperature t_n in films of beryllium bronze deposited on photoglass. To evaluate

the phase component of σ the author studied the structure in the same range of t_n ; the author found that up to $t_n \approx 220^\circ$ only lines of the α -solid solution are present, above that it is a mixture of the α - and γ -phases. She found that the dependence of the lattice parameter of the α -solid solution (a_α) on t_n has a maximum. It is assumed that the maximum arises as a result of the superposition of two processes: decay of the super-saturated α -phase during condensation on the one hand and increase in solubility of Be in Cu with growth in t_n on the other. Computation of the phase stresses using $a_\alpha = f(t_n)$ showed that they are insignificant. The conclusion is made that up to $t_n \approx 250^\circ$ the basic contribution to stresses of the first kind are made by the structural mechanism and above the effect of the thermal mechanism predominates. References 7.

USSR

UDC 669.14.018.85

STEELS FOR HEAT TRANSFER TUBE SURFACES OF HIGH-POWER HIGH-EFFICIENCY STEAM GENERATORS

Moscow TEPLOENERGETIKA in Russian No 10, 1976 pp 16-19

ANTIKAYN, P. A., ZUSMAN, V. M., GASHO, T. V., GREBENNIKOVA, T. T., MIKULINA, YU. D., SAMARETS, G. N., and TIKHONOVA, V. V., Moscow Branch of the Central Scientific Research, Planning, and Design Boiler and Turbine Institute imeni I. I. Polzunov

[Abstract] Perlite (12Cr1MoV and 12Cr2MoVSib), ferrite-martensite (1Cr11W2MoV), and austenite (Cr18Ni12Ti) steels are discussed for use in the heat-transfer surfaces in high-power steam generators and are compared with other similar foreign and domestic steels. The 12Cr1MoV steel has a creep strength of 80 MPa for 10^5 hr at 570°C . The Cr18Ni12Ti steel, which has up to 0.12% carbon and is used in outlet sections, shows defects after 15,000-30,000 hr. A 0Cr18Ni12Ti steel, which has up to 0.08% carbon, has a higher rupture strength, and a stable structure; but its heat and corrosion resistance are less. Reheat steam generators use 1Cr11W2MoV steel for temperatures up to 640°C . The corrosion resistance of Cr18Ni12Ti steel is reduced above 620°C . Other austenite steels have been developed, including EI695R, EP184, EP17, 45Cr10Mn14Al \cdot 2 (which has a 20-40% ferrite phase), 0Cr13Mn12Ni2NSi2, and 0Cr12Mn14Ni4AlMo. Figures 4; references: 5 Russian.

THE SURFACE QUALITY OF TUNGSTEN AFTER MECHANICAL WORKING

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No. 9, 1976 pp 160-162 manuscript received 7 Dec 75

DEMKIN, Yu.I., POLZIKOVA, T.V., SENIN, A.I., SUVOROV, A.A., FETISOV, G.V.

[Abstract] It was established earlier that end milling of rolled sintered type V-PM tungsten developed highest tool speed for cutting in a medium of liquid metal lead melt. Tool life was more than doubled. The present article presents a more careful study of the surface of the tungsten as a function of the milling conditions of this same alloy. The surface layer of the metal was studied after milling under ordinary conditions, in a lead melt at 400 C and when simply heated to 400 C. Tungsten surface quality was evaluated on the basis of roughness, presence of cracks and depth of strain-hardened layer. The differences in surface structure under various milling conditions were so slight that they could not be established by ordinary metallographic methods. Furthermore, the presence of cracks only in the subsurface layers and the differing depth of strain hardening indicate that the primary difference in mechanical working of tungsten is not in the surface itself, but rather in the subsurface layers. Subsequent studies will be directed toward the subsurface layers and expansion of methods of surface investigation. 5 references.

EFFECT OF RESTORATIVE HEAT TREATMENT ON THE STRUCTURE AND PROPERTIES OF 12Cr1MoV STEEL STEAM PIPES

Moscow TEPLOENERGETIKA in Russian No 10, 1976, pp 22-25

MINTS, I. I., BEREZINA, T. G., and KHODYKINA, L. Ye., Ural All-Union Institute, Chelyabenergo

[Abstract] Heat treatment [HT] was performed to restore steam pipes of 12Cr1MoV steel that had been operated for 80,000-100,000 hr at a stress of 100 MPa. The pipes had a residual strain of 0.2-0.3%. During usage, the ferrite solid solution had deteriorated, the Cr, Mo, and V alloying elements had been redistributed, VC, Me₂₃C₆, and Me₇C₃ carbides had formed, and there were 0.05-0.2 μ m micropores formed at the carbide-matrix interfaces. The pipes were treated for 20 minutes at 980° or 1,050°C, followed by tempering for 3 hr at 730°C. In general, the HT restored the steel properties to within the specified properties. The 0.05-0.2 μ m pores were closed by 1,050° HT, but not by 980° HT, and HT did not affect pores > 1 μ m. The creep strain of prestrained (0.5-2%) samples was < 2% after 7,000 hr for 1,050° HT, but > 2% in 1,400-4,800 hr for 980°C HT. Figures 3; references: 4 Russian.

USSR

UDC 666.291+539.4

STANDARDIZATION OF THE ESTIMATE OF IMPACT STRENGTH OF ENAMEL COATINGS

Moscow STEKLO I KERAMIKA in Russian No. 10, Oct 76 pp 18-20

GORBATENKO, V.Ye., KRICHEVSKIY, Yu.I., Novocherkassk Polytechnical Institute

[Abstract] In order to determine the factors which define the form of rupture and to develop a standardized approach to evaluation of the impact strength of coatings, the Laboratory of Enamels and Enameling of Metals of Novocherkassk Polytechnical Institute has performed a series of studies including both experimental and theoretical study of the process of rupture of an enamel coating. It has been established that one factor which has a qualitative influence on this process is the plastic deformation of the metal. The enamel-metal system represents a rigid connection between the elastic-plastic metal base and the brittle glassy coating. Therefore, when mechanical forces act on the system, particularly impact, two versions of reception of the load are possible, depending on whether the metal base remains undeformed after the impact or whether its surface is significantly curved and dented by the impact. For enamel coatings on ferrous metals, the following types of testing are recommended: cracking impact testing, penetrating impact testing and deforming impact testing. For coatings on metals with high ductility, yet another type of testing is required, characterizing the degree of collapse of the metal base in the contact area, which is of primary significance, since the total decrease in thickness of the specimen which it causes may be several times the thickness of the coating layer itself. Considering these peculiarities, it is necessary to determine the impact strength upon crushing of the metal and correspondingly to perform tests with "crushing impact." The first condition for standardization of methods of testing of impact resistant enamel coatings is therefore precise delineation of the types of testing providing for proper comparison of similar characteristics of rupture of the enamel layer. Brief recommendations for this type of delineation are presented. 12 references.

USSR

UDC 666.3:549.632

DENSELY COMPACTED CORDIERITE CERAMIC WITH EXPANDED SINTERED STATE INTERVAL

Moscow STEKLO I KERAMIKA in Russian No. 10, Oct 76 pp 24-26

TAKHER, Ye.A., DAYN, E.P., FEDOSEYEVA, T.I., SHVORNEVA, L.I., LUKOPEROVA, M.G., State Scientific Research Institute for Glass

[Abstract] A study was performed in order to produce a cordierite material with the lowest possible roasting temperature and an expanded sintered state range. In developing the material, the experience of synthesis of traditional cordierite ceramics was considered, as well as the advantages of glasses with crystallization tendency. Glasses of two compositions were used in the study:

non-zirconium glass and glass containing zirconium dioxide. The raw materials included Shabrovsk deposit talc, Druzhkovsk deposit clay, technical alumina and zircon. The glass making temperature was 1500-1520 C. Specimens were produced by the method of semidry pressing at 15 MPa. The heat treatment temperature of the specimens varied between 1800 and 1350 C. The heating rate was 3 C/min. The work performed resulted in the production of a densely compacted cordierite ceramic with a broad sintering range and optimal roasting temperature of 1300±40 C. The material produced has good physical and technical properties and is recommended for the manufacture of products by the method of semidry and plastic formation. 5 references.

USSR

UDC 532.57+532.137+536.51+532.14.08+531.787

FURTHER DEVELOPMENT IN THE METHOD OF STROBOSCOPIC VISUALIZATION
OF A FLOW: THE "THREE-COORDINATE" METHOD

Novosibirsk EKSPERIMENTAL'NYYE ISSLEDOVANII STRUKTURY PRISTENNOY
TURBULENTNOY I VYAZKOY PODSLOYA [Experimental Investigations of
the Structure of a Wall Turbulent and Viscous Sublayer, Collection
of Works] in Russian, 1976 pp 13-32

ORLOV, V. V. and MIKHAYLOVA, YE. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10B1318 by L. A. Gus'kov]

[Text] To ensure simultaneous photoregistration of the three components of the velocity vector of particle markers the authors use the effect of light reflection emitted by particles from a flat mirror surface by one of the walls which bound the region of the investigated turbulent flow. In the work they give the derivation of formulas for computing the coordinates of the markers and give analyses of the depth of field of the photographic system and the influence of astigmatism. They give recommendations on decreasing the influence of astigmatism and also formulate the requirements for the lighting conditions. For measurement of the pictures in the work they used a semi-automatic device which permits registering the coordinates of the particle tracks on paper tape, thus making it possible to further process the information on a computer.

USSR

UDC 681.2-52

INDIRECT MEASUREMENT OF FORCES IN THE DRIVE UNITS OF AN INDUSTRIAL ROBOT

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No 9, 1976 pp 65-67 manuscript received 10 Nov 75

KRAVCHENKO, N. F., ZHABOTINSKIY, YU. D., NIKITIN, M. M., and ROZHANSKIY, YU. Z.

[Abstract] One possible method for determination of the forces and moments of forces applied to the moving elements of an industrial robot by its drive units without additional loading of its elements is described. The method consists in the use of the dynamic equations of motion of the robot and its kinematic equations, constructed by high speed cinematography. Cinematography allows accurate determination of certain important kinematic characteristics of the robot, including: time of acceleration and time of deceleration of each element, processing cycle, amplitudes and frequencies of oscillation when movement is stopped. 2 references.

USSR

UDC 532.517.4

INVESTIGATION OF HEAT TRANSPORT IN A STRONGLY NONISOTHERMAL AXI-SYMMETRIC STREAM

Minsk TEPLOMASSOOBMEN [Heat and Mass Exchange, Collection of Works] in Russian, Vol 1, Part 1, 1976 pp 35-42

USTIMENKO, B. P., ZMEYKOV, V. N. and SHISHKIN, A. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B140 by V. A. Frost]

[Text] The authors give the results of an experimental investigation on the intensity of pulsations in temperature, spectral characteristics and correlations of the axial component of flow velocity and temperature in an axisymmetric stream behind a vertically placed 30-mm diameter nozzle with initial heating to 500° and velocity of 50-60 m/sec. The Reynolds number was varied in the range of $(2 - 10) \times 10^4$. The turbulent characteristics were determined by an ac hot-wire anemometer and the temperature pulsations by thermocouples with a 10-micrometer junction diameter with thermal inertia compensation. The measurements were made to a distance of 20 caliber. The authors mention the influence of the heater on the size of the correlation of axial velocity and temperature.

USSR

UDC 536.24:631.438.001.4

THE ACCURACY OF DETERMINATION OF THE TEMPERATURE OF THE GAS BEFORE TURBINE DURING JET ENGINE STAND TESTING WITH HEATED INTAKE AIR

Ufa ISPYTANIYA AVIATS. DVIGATELEY in Russian No 3 1975 pp 107-110

AKSEL'ROD, S. Ye. and SUVOROV, S. G.

[From REFERATIVNYY ZHURNAL AVIATIONNYE I RAKETNYE DVIGATELI No 9 1976 Abstract No 9.34.102 from the resume]

[Text] A calculated estimate of the error of determination of gas temperature before turbine resulting from failure to consider the presence of combustion products in the air entering the combustion chamber during jet engine stand testing with heated air intake is presented. It is established that this failure leads to an increase in the gas temperature before the turbine, the value of which depends not only on the level of intake and atmospheric temperature, but also on the level of the actual temperature before the turbine and where $T_{in} = 350$ C, $T_n = -40$ C and $T_3^* = 1350$ C, exceeds 20 C. It is suggested that where $T_{in} > 200$ C and $T_3^* > 1000$ C, when the error exceeds 5 C, a correction be introduced to the estimate of T_{in} tests with heated intake air.

USSR

UDC 551.345:551.49

CRYOLITHOGENESIS, ITS PECULIARITIES AND PLACE IN PROCESSES OF SEDIMENT FORMATION IN THE EARTH

Novosibirsk REGIONAL'NYYE I TEMATICHESKIYE GEOKRIOLOGICHESKIYE ISSLEDOVANIYA (Regional and Thematic Geocryological Studies) in Russian 1975 pp 98-113

GASANOV, Sh.Sh.

[Abstract] The peculiarities of the cryogenic type of lithogenesis are as follows: 1) the entire process of sedimentary rock formation occurs at below-freezing temperatures with long-term existence of ice as an important agent in the migration of matter and an important component part of the rock arising in the course of cryolithogenesis; 2) the process of disintegration of rock is clearly of the sand-aleurite type, which corresponds most closely to the thermodynamic conditions of the cryosphere; 3) during the course of the eluvial process developing under these specific physical geographic and geochemical conditions, a clearly differentiated cryogenic weathering crust profile develops; 4) most factors involved in the rupture, migration and differentiation of matter are typomorphic; 5) the products of cryolithogenesis in all stages are characterized by low mechanical sorting and imprecise facies differentiation as to granulometric composition; 6) the processes of leaching, vertical redistribution, the sequence of transport and precipitation of chemical compounds and elements have specific features determined by the temperature. The most important cryogenic physical-chemical processes occur by the interaction of thin films of adsorbed water and mineral particles; 7) in some stages of cryolithogenesis, certain and specific paragenetic complexes of rock are formed, differing significantly from rock developing outside the cryosphere. The corresponding products of lithogenesis can be combined into five paragenetic complexes corresponding, probably, to the rank of geological formation. 43 references.

USSR

UDC 551.345:551.49

PECULIARITIES OF ZONES OF AERATION OF THE CRYOLITHOZONE

Novosibirsk REGIONAL'NYYE I TEMATICHESKIYE GEOKRIOLOGICHESKIYE ISSLEDOVANIYA (Regional and Thematic Geocryological Studies) in Russian 1975 pp 133-138

YEFIMOV, A.I., KOLDYSHEVA, R.Ya.

[Abstract] New concepts are presented concerning the zone of aeration in the area of development of permafrost. Based on thematic studies, a plan of its structure is presented for mountain regions (on the example of the regions east and west of Lake Baikal). The peculiarities of the aeration zones are described. The work is based on the experience of composition of a map of aeration zones in 1:5 million scale for the territory of the Soviet Union. In

permafrost areas, the aeration zone is defined as the layer of rock between the surface and the water-bearing horizon with free water level, in which the infiltration water comes in contact with the air contained in cracks and pores of the rock. 14 references.

USSR

UDC 551.345:551.49

RESULTS OF DETERMINATION OF THE DEEP HEAT FLUX IN THE TERRITORY OF YAKUTIA

Novosibirsk REGIONAL'NYE I TEMATICHESKIYE GEOKRIOLOGICHESKIYE ISSLEDOVANIYA (Regional and Thematic Geocryological Studies) in Russian 1975 pp 148-150

DEVYATKIN, V.N.

[Abstract] The first results are presented from determination of the heat flux in frozen and subfrozen layers of the crust in the territory of Yakutia. The geothermal measurements covered various geological-tectonic structures in the territory. Particular attention was given to measurement of the equilibrium geothermal gradient and extraction of cores from layers with varying lithology with subsequent determination of the heat conductivity of the rock under laboratory conditions. Data on the relationship of heat fluxes in frozen and underlying layers of the crust allow us to judge the paleoclimate and geologic history of a region and can be used to predict changes in the thickness of frozen rock. 8 references.

USSR

UDC 532.546

UNSUITABILITY OF FORMULAS OF AN ELASTIC REGIME FOR DETERMINING THE COEFFICIENTS OF FILTRATION OF ROCKS IN FLOWS OF SUBTERRANEAN WATERS IN COAL BEDS

Kiev TEKHNologIYA OTKRYTYKH GORNYKH RABOT [Technology of Open Mines, Collection of Works] in Russian, 1976 pp 101-102

KOSHEVOY, N. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B1005 by V. G. Krupenya]

[Text] On the basis of analyzing test data on pumping water from mines in coal reserves the author concluded that the formulas of an elastic nonstationary regime of filtration are unsuitable for determining the coefficient of permeability. The author considers that the basic reason for the noncorrespondence is the presence of significant influxes of water from the surrounding areas which also cause the stationary regime during pumping.

USSR

UDC 531/539

INFLUENCE OF INITIAL BENDING ON FREQUENCY OF FREE OSCILLATIONS OF PLATES

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied Mechanics -- Collection of Works] in Russian 1974 pp 371-379

KALININ, V.S., Leningrad Ship-building Institute

[Abstract] A study is made of slight free oscillations of an elongated rectangular plate with an initial bend relative to its equilibrium position corresponding to the transverse static load and reactive tangential forces resulting from the limitation of the tangential displacements of the edges of the plate. The equation produced for the oscillations has a component of the first order of magnitude which considers the change in tangential force due to oscillations. This component influences the frequency of small oscillations to the same extent as the tangential force acting in the position of equilibrium. A practical example indicates that with relatively slight initial bending and transverse loads, the spectrum of eigenfrequencies is significantly changed, sometimes even qualitatively. 6 references.

USSR

UDC 531/539

THE INFLUENCE OF DYNAMIC LOADS ON CERTAIN ELASTIC SYSTEMS WITH SNAP-THROUGH BUCKLING

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied Mechanics -- Collection of Works] in Russian 1974 pp 439-443

KUZNETSOV, Ye.B., KULAKOV, N.A., SHALASHILIN, V.I., Moscow Aviation Institute imeni S. Ordzhonikidze

[Abstract] A study is made of the problem of determination of the maximum value of constant and sediment loading which can be applied to nonlinear systems such as a dual-rod beam, smooth arch, smooth spherical panel loaded by external pressure, etc. without causing snap buckling. This load is called the critical snap loading. Analysis of the solution for the deformation criterion shows that in the process of dynamic snapping, the arc is first deformed over the symmetrical component of bending. The asymmetrical component begins to rise rapidly only as the unstable position of equilibrium is approached. In other words, as the position of unstable equilibrium is approached, the asymmetrical component arises due to longitudinal-transverse bending effects. 10 references.

USSR

UDC 531/539

DETERMINATION OF THE CENTER OF BENDING OF A CANTILEVER WITH A TRIPLY CONNECTED CROSS SECTION

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied Mechanics -- Collection of Works] in Russian 1974 pp 31-42

AMENZADE, Yu.A., MUSTAFAYEV, M.I., Azerbaijan State University

[Abstract] The center of bending is determined for a cantilever, the cross section of which is a triply connected area limited by two concentric circles and an ellipse. The problem of determination of the complex torsion function is reduced by means of an analytic continuation theorem to the Dirichlet problem for a circular ring. The complex torsion function determined is used to determine the coordinates of the center of bending of the cantilever. A numerical example is presented. 4 references.

USSR

UDC 531/539

DETERMINATION OF UNSTABLE LOADS UNDER THE INFLUENCE OF INTERNAL WAVE SOURCES

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied Mechanics -- Collection of Works] in Russian 1974 pp 53-62

BABAYEV, A.E., GUZ', A.N., KUBENKO, V.D., Institute of Mechanics, Acad. Sci. UkrSSR

[Abstract] A study is made of the determination of unstable hydrodynamic loads on the internal surface of rigid vessels filled with a compressible liquid or gas under the influence of internal wave sources; this is the first portion of the problem of determination of the stress-strain state of elastic structures. According to the statement of the problem, the point source radiating the unstable wave beginning at a certain time produces a wave which, as it strikes the surface of the undeformable vessel, generates a reflected wave which, in turn, is repeatedly reflected, producing a complex and rapidly changing wave field within the vessel. The problem is essentially one of determining the pressure on the internal surface of the vessel. 12 references.

USSR

UDC 621.74.011

RHEOLOGICAL MODEL AND EQUATION FOR ALUMINUM-SILICON ALLOYS IN THE CRYSTALLIZATION INTERVAL

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No. 9, 1976 pp 124-128 manuscript received 1 Apr 76

KASHIRTSEV, L.P.

[Abstract] Based on analysis of experimental curves of the flow of aluminum-silicon alloys with undamaged structure in the crystallization interval, a rheological model of the alloys is developed. Rheological equations are produced and the parameters of alloys in the Al-Si system for these conditions are presented. The alloys discussed are basically Al+0.6, 2.52, 5.24 and 10.36% Si. The equations produced can be used as a basis for calculation of processes of casting feed and the development of stresses and deformations in castings upon freezing. 3 references.

USSR

UDC 533.6071.4.001

PECULIARITIES OF GAS FLOW INTO THE ATMOSPHERE UPON "AVALANCHE" RUPTURE OF A GAS LINE

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No. 9, 1976 pp 141-145 manuscript received 17 Feb 76

MAKAROV, G.I., VINOKUROV, V.A.

[Abstract] A study is made of an infinitely long pipe of constant diameter lying freely upon the ground, within which compressed gas is contained. A longitudinal crack develops in the pipe and propagates along the pipe in both directions. The motion of only the right end of the crack is analyzed. It is considered that after damping of the transient processes related to the beginning of rupture, the gas flow in the undamaged portion of the pipe becomes homogeneous. The processes of rupture of the pipe and leakage of gas from it occur at high velocity; therefore, heat exchange with the environment cannot occur. The thermodynamic process can therefore be considered adiabatic. The analytic dependences for the flow parameters at the tip of the traveling crack on velocity of crack tip movement are produced. It is shown that the calculation curve of pressure at the end of the crack as a function of crack propagation velocity agree well with experimental data. 5 references.

BASIC EQUATIONS IN THE THEORY OF THIN-WALL THREE-DIMENSIONAL SYSTEMS OF LINEARLY ELASTIC MATERIALS

Dushanbe DINAMIKA I SEISMOSTOYKOST' ZDANIY I SOORUZHENII [Dynamics and Seismic Resistance of Buildings and Facilities, Collection of Works] in Russian, Izd-vo Donish, 1976 pp 59-65

KOZHARINOVA, L. V.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10, 1976 Abstract No 10V243 by Ye. M. Zveryayev]

[Text] The author derives equations of state of a plate on the assumption that the dependence between the intensity of stresses σ_i and the intensity of strains ϵ_i has the form

$$\sigma_i = E\epsilon_i - m\epsilon_i^3.$$

The author uses the Kirchhoff-Love hypotheses and assumes that the axial line of the contour of the cross section undergoes no elongation strains. The author gives the expression of energy of strain of the plate with the aid of which she obtains formulas that associate the moments and stresses with the strains. For the movements she obtains a system of nonlinear differential equations. Similar relationships are given for the folds.

ON ALLOWING FOR THE INERTIA OF ROTATION AND TRANSVERSE SHIFT IN PROBLEMS ON NATURAL OSCILLATIONS OF SHELLS

Tula SBORNIK NAUCHNYKH TRUDOV KAFEDRY VYSSHEY MATEMATEKI. TUL'SK POLITEKHNIЧЕСКИЙ ИНСТИТУТ [Collection of Scientific Works of the Department of Higher Mathematics. Tula Polytechnic Institute] in Russian, No 3, 1975 pp 30-34

POPOV, A. G.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V265 by the author]

[Text] The author investigates high-frequency oscillations of cylindrical shells in the frequency range of 6 to 50 kHz and above. The experimental eigenfrequencies and shapes of shell oscillations, rigidly fastened on one end and free of the others, are compared with the values obtained on the basis of the theory which takes into account the inertia of rotation and strain of the transverse shift. The author gives an example of the numerical computations.

USSR

UDC 62-135:[531.3+539.4.01]

USE OF THE METHOD OF DYNAMIC TESTING FOR CALCULATION OF THE PARAMETERS OF THE BONDS OF AN ELASTICALLY SUSPENDED SOLID

Moscow DINAMIKA I PROCHNOST' UPRUGIKH I GIDROUPRUGIKH SISTEM (Dynamics and Strength of Elastic and Hydroelastic Systems -- Collection of Works) in Russian 1975 pp 21-27

GLUKHAREV, K.K., ROZENBERG, D.Ye.

[Abstract] A study is made of the procedure of the method of dynamic testing as applicable to calculation of the parameters of the bonds of a solid. The parameters of linear chain mechanical systems are calculated on the basis of the results of observation of the motion of concentrated inertial elements (masses or discs). The conditions of existence of the resolving operation of the method of dynamic testing are indicated, as well as the minimum number of measurements necessary for construction of the resolving operation. The potential energy of the system is calculated on the assumption that the potential forces depend linearly on the deformations of the bonds. When there are over six bonds, linearized equations cannot be used to construct the resolving operation. 2 references.

USSR

UDC 62-135:[531.3+539.4.01]

STUDY OF NONLINEAR RANDOM OSCILLATIONS BY MEANS OF SYSTEMS OF CORRELATION FUNCTIONS

Moscow DINAMIKA I PROCHNOST' UPRUGIKH I GIDROUPRUGIKH SISTEM (Dynamics and Strength of Elastic and Hydroelastic Systems -- Collection of Works) in Russian 1975 pp 27-33

ANIKEYEV, G.I.

[Abstract] A study is made of unstable random processes in systems with multiple degrees of freedom. It is assumed that external forces act on the system which depend on many random parameters; furthermore, the parameters of the system itself are also assumed to be random functions of time. The distribution functions of these random quantities may be arbitrary. The external perturbing forces and parameters of the system are assigned by a system of correlation functions of second or higher order. A system of equations is constructed for unknown random quantities containing correlation functions of the same order. 2 references.

USSR

UDC 539.375

ON THE DESTRUCTION OF WALLS OF A T-SECTION AND AN H-SECTION ACTED ON BY AN INTERSECTING FORCE

Moscow MOSKOVSKIY AVIATIONNYE INSTITUT [Moscow Aviation Institute] in Russian, 1976, 8 p, Deposited in the All-Union Institute of Scientific and Technical Information, 15 Jun 76, No 2174-76Dep

MOVCHAN, A. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V639 DEP by the author]

[Text] The author examines the question on increasing accuracy of computing the coefficient of intensity of stresses at the peak of a sharp crack by using an energy method for short cracks. The author suggests using a special superelement for this, whose components of the rigidity matrix are defined with the aid of an iteration procedure. The method permits obtaining the value of K_I with an accuracy up to 5% for a crack on the edge of which is only finite element. With the aid of the proposed method he finds the dependence of the coefficient of intensity of stresses on the length of the crack which is developing the walls of the T-section and the H-section. The author finds that the presence of the initial defects in the walls of the T-section is extremely hazardous, whereas the H-section has little sensitivity to cracks existing in its wall.

USSR

UDC 539.375

FEATURES OF THE GROWTH OF A CRACK UNDER LASER LOADING

Kiev IV VSESOYUZNIY S"YEZD PO TEORETICHESKOY I PRIKLADNOY MEKHANIKI, 1976. ANNOTATSIYA DOKLADOV [Fourth All-Union Conference on Theoretical and Applied Mechanics, 1976. Annotation of Reports, Collection of Works] in Russian, Izd-vo Naukova Dumka, 1976 p 101

MUL'CHENKO, B. F., PILIPETSKIY, N. F. and SAVANIN, S. YU.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V668]

[Text] The authors measure the rate of growth of cracks in a volume of transparent materials under impulse laser loading. They use "gigantic impulses" with a duration of about 10^{-8} sec and impulses of free laser generation with a duration of about 10^{-3} sec. The measurements were conducted on high-speed photoelectron registers of FER and SFR type. During irradiation by

the "gigantic impulse" they obtain values of the rates of growth of the cracks which exceed sonic velocities in the materials. They note several features in the growth of flat round cracks during laser irradiation with an impulse duration of about 10^{-3} sec. Annotation

USSR

UDC 624.131+539.215

CREEP OF HEAT-RESISTANT CONCRETE ON PORTLAND CEMENT

Minsk STROITEL'NYYE KONSTRUKTSII [Building Construction, Collection of Works] in Russian, 1976 pp 150-158

MILOVANOV, A. F. and GLUSHKOV, V. T.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V729 by I. G. Bulina]

[Text] The authors investigated the dependence between stresses and strains of the creep of heat-resistant naturally hardened concretes, the heating of which was done under a load. Test samples in the form of 10 x 10 x 40 cm prisms were prepared on Portland cement with a fireclay filler. The samples were tested for core compression at normal temperature and uniform heating from 100 to 700° at different rates of heating. The authors note the substantial increase in creep strains in concrete heated to 300° in the first 16-20 days, the increase in load, which produces a notable development of them. Rapid creep strains in the process of temperature elevation do not depend on the amount of stress, but depend only on heating temperature. The rate of their development reaches a maximum value upon heating to 500-700°. The creep strains, developing during the holding time at the assigned temperature and load, depend linearly on the compressive stress. With increase in temperature the degree of nonlinearity grows and depends on the duration of heating. By introducing temperature functions the authors obtain two approximating dependences for describing creep strain curves: one for strains developing in the process of temperature elevation, and the other -- for strains observed in the process of holding at the assigned temperature.

USSR

UDC 624.07:534.1

ON THE NATURAL SHAPES AND FREQUENCIES OF A ROTATIONAL-SYMMETRICAL SYSTEM WITH IMPERFECTIONS

Kuybyshev NAUCHNYYE TRUDY. KUBYSHEVSKIY AVIATIONNYYE INSTITUT [Scientific Works. Kuybyshev Aviation Institute] in Russian, No 2(73), 1975 pp 34-44

IVANOV, V. P. and SERDOTETSKIY, A. S.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V283 by the authors]

[Text] The authors examine oscillations of a rod system with other bonds and not completely identical dynamic characteristics of the elements. The system is a schematization of the blade halos of turbomachinery which permits tracing the influence of different frequencies of the blades on the natural shapes and frequencies of the associated oscillations of the halo. They use the method of perturbations. For the natural shapes and frequencies of the system they obtain corrections that depend on the degree of asymmetry of the system. For several specific cases they give the numerical computations. With the obtained approximate solution they find a precise solution and also indirect approximations of the errors. References 5.

USSR

UDC 539.3:534.1

DETERMINATION OF THE COMPUTED STABILITY OF COMPRESSED SHELLS OF ROTATION

Leningrad TRUDY LENINGRADSKOGO INSTITUTA AVIATIONNOGO PRIBOROSTROYENIYA [Works of the Leningrad Institute of Aviation Instrument Construction] in Russian, No 97, 1976 pp 57-64

SEROV, N. A.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V337 by V. I. Mamay]

[Text] The author discusses three possible ways of evaluating the size of the normative values of critical pressures of cylindrical, conical and spherical shells: experimental, theoretical deterministic and probability. In discussing the possibilities of the second way he introduces the concept of "requirement of stability" (the author's terminology), by which he means such limitations on geometric and rigidity parameters of the shell as well as the character of the perturbations for which the

construction has little sensitivity to small changes in these sizes. The author gives several qualitative arguments on the possibilities of the discussed approaches. References 9.

USSR

UDC 539.374

ON THE MOVEMENT OF A PLASTIC STRING IN A UNIFORMLY DISTRIBUTED IMPULSIVE LOAD

Moscow IZBRANNYYE VOPROSY DINAMIKI [Selected Questions in Dynamics, Collection of Works] in Russian, Izd-vo Nauka, 1976 pp 103-106

BOYKO, L. L.

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10V509 by Yu. V. Suvorova]

[Text] The author examines the problem of movement of a string having a length of $2a$, fastened at the ends acted on by a uniformly distributed impulsive load leading to the instantaneous appearance of an initial velocity V_0 at all points on the string except its ends. The author suggests that the process of movement of the string is accompanied by propagation from the edges toward the center of a wave of consolidation such that any moment of time one observes both a middle zone -- the zone of plastic deformation -- and the consolidating parts adjacent to it. The problem is solved with the aid of the method of replacing the continuous distribution of mass of the string by a discrete one at $n = 2k-1$ individual points. The system of determining equations consists of $2k$ equations relative to such a number of unknown functions. The author writes the first integral of the system -- the integral of energy. He obtains the limiting transition for $n \rightarrow \infty$. The system of equations here is transformed into a system of two equations in partial derivatives which describe the movement of the inner part of the plastic string up to which the wave of consolidation has still not arrived. These equations were not solved.

USSR

UDC 532.516

ON THE INSTABILITY OF THE SPHERICAL COUETTE FLOW (EXPERIMENT AND CERTAIN THEORETICAL QUESTIONS)

Kiev IV VSESOYUZNIY S"YEZD PO TEORETICHESKOY I PRIKLADNOY MEKH-
NIKE, 1976 [Fourth All-Union Conference on Theoretical and Ap-
plied Mechanics, 1976, Collection of Works] in Russian, Annota-
tions of Reports, Izd-vo Naukova Dumka, 1976 p 43

BELYAYEV, YU. N., MONAKHOV, A. A. and YAVORSKAYA, I. M.

[From REFERATIVNIY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10B86]

[Text] An experimental investigation was conducted on the sta-
bility of a spherical Couette flow upon rotation only of the in-
ternal sphere in layers of different thickness. The curve of
stability was found as well as the form and the length of the
wave of the secondary flows near the limit of stability. The au-
thors detected a new type of instability in the spherical Couette
flow in thick layers. They investigated the various secondary
flow regimes arising with growth in Re all the way up to trans-
ition to the turbulent regime. In fully developed turbulent flow
in thin layers with growth in Re one notes the onset on a back-
ground of turbulent pulsations of large-scale structures similar
in form to the perturbations near the limit of stability, but
greater in wavelength. An attempt is made to analyze theoreti-
cally the various types of instability. Annotation.

USSR

UDC 532.512.4

EXPERIMENTAL INVESTIGATION OF THE COMBINED FUNCTIONS OF PROBABIL-
ITY DENSITY DISTRIBUTION OF TURBULENT PULSATIONS IN VELOCITY AND
CONCENTRATION

Kiev IV VSESOYUZNIY S"YEZD PO TEORETICHESKOY I PRIKLADNOY MEKH-
NIKE, 1976 [Fourth All-Union Conference on Theoretical and Ap-
plied Mechanics, 1976, Collection of Works] in Russian, Annota-
tions of Reports, Izd-vo Naukova Dumka, 1976 pp 42-43

BEZUGLOV, V. A., GOLOVANOV, YU. V. and SHCHERBINA, YU. A.

[From REFERATIVNIY ZHURNAL, MEKHANIKA No 10 1976 Abstract No
10B136]

[Text] The investigations of the combined functions of probabili-
ty density distribution of pulsations in velocity and concentra-
tion have scientific, practical and methodical significance. The

literature has no data on these functions. To measure the special functions of probability density distribution the authors developed a special method based on the local optical method of measuring pulsations in concentration and on the laser Doppler velocity meter. On the basis of the investigated functions on the submerged stream the authors obtained the unknown functions of velocity pulsations and concentration pulsations which are near the data of other authors. Using the method thus tested they obtained the combined functions of probability density distribution at different points of the stream including those in the presence of intermittence. The obtained data are discussed relative to the theoretical description of pulsations in concentration in turbulent diffusion. Annotation.

USSR

UDC 531/539

THE SOLUTION OF INTEGRAL EQUATIONS FOR CONTACT PROBLEMS

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKHANIKI [Selected Problems of Applied Mechanics -- Collection of Works] in Russian 1974 pp 271-281

GRIGOLYUK, E.I., TOLKACHEV, V.M., Institute of Mechanics, Moscow State University

[Abstract] A discussion is presented of the types of integral equations produced by reducing the problem of determination of the interaction of a cylindrical shell with other objects such as ribs, sharp stamps and other shells. The discussion is conducted for cases in which the zones of contact can be considered line sectors on the generatrix or circular arcs of the cross section of the shell. The initial equations are converted to Fredholm equations of the second kind, which can be easily solved numerically using a quadrature formula presented in the work. In the process of transformation, a solution is produced to the characteristic equations corresponding to the initial equations, a special type of differentiation formula for singular integrals is presented, and a generalized solution is analyzed which contains concentrated forces at the ends of the contact zone. Singularities in the reactions at the ends of the contact zone are distinguished. 12 references.

STABILITY OF AN IRREGULAR CYLINDRICAL ENVELOPE OF VARIABLE THICKNESS,
DISCRETELY SUPPORTED BY RINGS, UNDER THE INFLUENCE OF AN AXIAL LOAD AND LATERAL
PRESSURE WHICH IS VARIABLE ALONG THE LENGTH

Moscow IZBRANNYYE PROBLEMY PRIKLADNOY MEKhanIKI [Selected Problems of Applied
Mechanics -- Collection of Works] in Russian 1974 pp 63-71

BADRUKHIN, Yu.I., GALKIN, S.I., Moscow Institute of Physics and Technology

[Abstract] The full equations are used to solve the problem of stability of an irregular cylindrical envelope which is supported by discrete rings and which has thickness which varies linearly within sections, under the influence of an axial load and lateral pressure which is linearly variable along the length. The subcritical state of the sections is defined by the nonlinear axisymmetrical edge effect equations. No assumptions are made concerning deformations of the midsurface of the sections or the neutral line of a ring. Determination of the subcritical state and actual solution of the problem of stability are performed using exponential series with respect to an axial coordinate. A rather simple algorithm is developed and programmed for the type M220 computer for determination of the critical parameters. Numerical results are produced for certain problems which flow from the statement used. The experience gained in programming and numerical solution indicate that the method developed can be used to produce reliable results. The use of exponential series shows their good effectiveness in the solution of problems of strength and stability of envelopes. Exponential series are particularly effective as applied to reinforced envelopes with section lengths not over half the radius. 4 references.

Turbine and Engine Design

USSR

UDC 629.7.036.3:533.6

EXPERIMENTAL STUDY OF THE OPERATION OF TURBINE EXHAUST PIPES AS A FUNCTION OF DESIGN AND MODE PARAMETERS

TR. MOSK. AVIATS. IN- $\overline{\text{TA}}$ in Russian No 352, 1976 pp 79-86

RAGOZIN, Yu. N.

[From REFERATIVNYY ZHURNAL AVIATIONNYYE I RAKETNYYE DVIGATELI No 9 1976 Abstract No 9.34.41]

[Text] In order to study the influence of torsion on the operation of diffusers following turbines, axisymmetrical circular diffuser devices were tested. The twisting of the air stream blown through the diffusers was created by variable axial blade twisting apparatus with mean radius $R_2 = 44$ mm. 4 figures, 4 references.

USSR

UDC 621.438.67-71

EXPERIMENTAL STUDY OF COOLING OF THE NOZZLE BLADES OF A GAS TURBINE ENGINE

Ufa ISPYTANIYA AVIATS. DVIGATELEY in Russian No 3, 1975 pp 111-118

KAPUSTIN, N. K., FEDOROV, V. N. and TRUSHIN, V. A.

[From REFERATIVNYY ZHURNAL AVIATIONNYYE I RAKETNYYE DVIGATELI No 9 1976 Abstract No 9.34.45 from the resume]

[Text] Results are presented from experimental-theoretical studies of a system of cooling of nozzle deflector blades of gas turbines with transverse flow of the cooling air with various designs of deflectors. It is established that the production of perforations in the forward portion of the deflector increases the effectiveness of blade cooling. Comparison of calculated temperatures in the blade wall with experimental temperatures shows that in the gap between the deflector and blade with Reynolds numbers up to $1:10^4$ a laminar flow mode is maintained with a gap of 0.5-0.8 mm. 5 figures, 2 tables, 3 references.

USSR

UDC 629.7.03:621.454:001

FORMATION OF DISPERSION OF RESONANT STRESSES IN BLADE HUBS

[NAUCH. TR.] KUYBYSHEV. AVIATS. IN-T in Russian No 2(73), 1975 pp 28-34

IVANOVA, V. P. and SERDOTETSKIY, A. S.

[From REFERATIVNYY ZHURNAL AVIATIONNYE I RAKETNYE DVIGATELI No 9 1976
Abstract No 9.34.36 from the resume]

[Text] A study is made of the regularities of development of dispersion of resonant stresses in blade hubs in operating turbine machines. It is shown that the source of dispersion of stresses is slight asymmetry of the hubs, which is always present. Three basic mechanisms are determined for the formation of dispersion under the influence of asymmetry (dispersions of types I, II and III). The theoretical concept is confirmed by experiments on special installations using models and natural hubs. 10 references.

USSR

UDC 629.7.036.3-226

DETERMINATION OF GEOMETRIC CHARACTERISTICS OF THE TRANSVERSE CROSS SECTION OF TURBINE BLADES

[NAUCH. TR.] KUYBYSHEV. AVIATS. IN-T in Russian No 2(73) 1975 pp 49-52

VOROB'YEV, Yu. S.

[From REFERATIVNYY ZHURNAL AVIATIONNYE I RAKETNYE DVIGATELI No 9 1976
Abstract No 9.34.38 from the resume]

[Text] The problem of determination of the basic geometric characteristics of a prismatic beam of asymmetrical cross section is solved for the case of complex loading. Geometric functions are found defining the deformations of the beam. The problem is reduced to solution of a system of equations used to determine the coordinates of the center of bending, the form factor of the transverse cross section with three-dimensional shear, torsional rigidity, etc. The method is realized on a digital computer. 4 references.

USSR

UDC 629.7.036.3-752

THE CONVERGENCE OF AN INTEGRAL EQUATION DESCRIBING THE OSCILLATIONS OF AN UNSUPPORTED ROTOR

TR. MOSK. AVIATS. IN-TA in Russian No 352, 1976 pp 61-72

STOLYAROV, V. F. and BUKATOVA, T. D.

[From REFERATIVNYY ZHURNAL AVIATIONNYE I RAKETNYE DVIGATELI No 9 1976 Abstract No 9.34.34 from the resume]

[Text] A method is suggested for improvement of the convergence of the process of successive approximations of the solution of the homogeneous integral equation with equality of the two adjacent characteristic numbers as to absolute magnitude, but different signs. Investigation of the influence of the adjusted mass moments of inertia of discs of a natural unsupported rotor at the natural oscillating frequency is also suggested. The homogeneous integral equation investigated describes the oscillations of an unsupported shaft with n discs. It is considered that the shaft oscillates by direct synchronous precession. Friction is ignored. It is considered that the mass of the discs and their mass moments are concentrated at the centers of gravity of the discs. 9 figures, 2 references.

USSR

UDC 629.7.036.3-752

DAMPING OF THE DRIVE WHEELS OF TURBINES BY MEANS OF VIBRATION-ABSORBING COATINGS

TR. MOSK. AVIATS. IN-TA in Russian No 352, 1976 pp 73-79

KARPOV, A. V.

[From REFERATIVNYY ZHURNAL AVIATIONNYE I RAKETNYE DVIGATELI No 9 1976 Abstract No 9.34.35]

[Text] Theoretical and experimental studies are presented of the damping of the drive wheels of turbines by means of vibration-absorbing coatings. The experiment confirms the possibility of effective damping of blades in a system of a disc with blades, the bed of which is equipped with a damping coating. 1 figure, 2 references.

USSR

UDC 621.454.733

REMOVAL OF LIQUID AEROSOLS FROM THE AIR AT THE INPUT TO A GAS TURBINE

Ufa ISPYTANIYA AVIATS. DVIGATELEY in Russian No 3 1975 pp 78-81

KHIMICH, V. L. and YENIKEYEV, G. G.

[From REFERATIVNYY ZHURNAL AVIATIONNYE I RAKETNYE DVIGATELI No 9 1976
Abstract No 9.34.69 from the resume]

[Text] This article is dedicated to analysis of the possibilities of separation of liquid particles in air at the input to a gas turbine by means of a rotary separator. Results are presented from experiments performed following estimation of the effectiveness of operation of a rotary separator with symmetrical blades twisted along the radius in a helical line. The separation factor which can be achieved and full pressure losses in the separator are studied as functions of the velocity of the stream flowing into the separator.

USSR

UDC 533.697

STUDY OF PROFILE LOSSES IN TURBINE FIELDS WITH PERMEABLE PROFILE SURFACE

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No. 9, 1976 pp 119-123 manuscript received 20 May 75

GRYAZNOV, N.D., YEPIFANOV, V.M., GUS'KOV, V.I., Moscow Higher Technical School
imeni N.E. Bauman

[Abstract] Experimental data are presented on the influence of the intensity and distribution of injection of cooled air, degree of roughness of porous material and amount of turbulence in the incident stream on profile losses in a turbine field consisting of permeable blades with injection. The primary advantage of air injection through permeable blades is the fact that it allows increased air temperatures around the blades and, therefore, increased air pressures and power outputs. A cross-sectional drawing of an experimental blade featuring injection is presented. The experiments show that the intensity and distribution of injection of secondary air into the boundary layer around a porous cooled blade, as well as the velocity of the stream and roughness of the porous surface all significantly influence profile losses. The influence of turbulence of the flow on profile losses decreases with intensive injection. 7 references.

EQUIPMENT
Gyroscopic

USSR

UDC 62-135:[531.3+539.4.01]

OSCILLATIONS OF NONCONSERVATIVE GYROSCOPIC SYSTEMS WITH RANDOM DISTRIBUTED
AND CONCENTRATED PARAMETERS

Moscow DINAMIKA I PROCHNOST' UPRUGIKH I GIDROUPRUGIKH SISTEM (Dynamics and
Strength of Elastic and Hydroelastic Systems -- Collection of Works) in
Russian 1975 pp 33-39

ZEYTMAN, M.F., TARAN, L.A.

[Abstract] A study is made of the bending oscillations of an elastic gyroscopic system with randomly changing parameters, including damping coefficients. The periodic solution is found by means of the method of a small parameter -- expansion into a series with respect to two small parameters reflecting the varying physical nature of the randomly changing quantities. Recurrent dependences are produced for determination of any approximation with respect to the forms of oscillations and frequencies. Formulas are presented for probabilities for estimation of the behavior of the system. 3 references.

USSR

UDC 62-135:[531.3+539.4.01]

BENDING OSCILLATIONS OF NONLINEAR ELASTIC GYROSCOPIC SYSTEMS WITH RANDOM
PARAMETERS

Moscow DINAMIKA I PROCHNOST' UPRUGIKH I GIDROUPRUGIKH SISTEM (Dynamics and
Strength of Elastic and Hydroelastic Systems -- Collection of Works) in
Russian 1975 pp 39-45

ZELENSKIY, V.B., ZEYTMAN, M.F.

[Abstract] A study is made of the forced periodic oscillations of quasilinear elastic gyroscopic systems with random distributed and concentrated parameters. Their behavior composes a mixed n -point boundary problem with $n+1$ quasilinear conjugation conditions at the points of placement of concentrated elements with random characteristics. The random changes of all quantities in the gyrosystem do not extend beyond certain small intervals, allowing the method of the small parameter to be used. 2 references.

UNSTABLE PROCESSES IN A ROTARY SYSTEM WITH VARIABLE MASS

Moscow DINAMIKA I PROCHNOST' UPRUGIKH I GIDROUPRUGIKH SISTEM (Dynamics and Strength of Elastic and Hydroelastic Systems -- Collection of Works) in Russian 1975 pp 67-76

SIL'VESTROV, E.Ye.

[Abstract] A study is made of unstable, near-periodic oscillations in a gyroscopic system with simultaneous change of the mass and the angular velocity of the rotor. The study is made of a non-inertial cantilever shaft with one unbalanced disc of variable mass at its free end. The mass of the disc is a function of "slow" time and changes according to a deterministic rule which is independent of the nature of motion of the system. Separation (or attachment) of particles of the disc occur at zero relative velocity. The particles do not move relative to the disc. The asymptotic Krylov-Bogolyubov method is used to produce equations for the first approximation for the amplitudes and phases of unstable self-oscillation processes. The influence of velocity and mass of the rotor as well as eccentricity on the amplitude of oscillations of the system is studied upon passage through the area of self-oscillation, in which the first frequency of direct precession appears. 5 references.

RESONANCE OSCILLATIONS AND DRIFTS OF A GYROSCOPE IN A UNIVERSAL JOINT

Kiev IV VSESOYUZNIY S'YEZD PO TEORETICHESKOY I PRIKLADNOY MEKHANIKE, 1976 [Fourth All-Union Conference on Theoretical and Applied Mechanics, 1976, Collection of Works] in Russian, Annotations of Reports, Izd-vo Naukova Dumka, 1976 p 26

KOPYTOV, V. I. and LESTEV, A. M.

[From REFERATIVNIY ZHURNAL, MEKHANIKA No 10, 1976 Abstract No 10A206]

[Text] The authors examine the oscillations and drift of astatic and unbalanced gyroscopes in a universal joint during vibration of the base. They study the nonlinear resonance phenomena during space oscillations of the case of the gyroscopic instrument, installed on shock absorbers. They give formulas for determining the angular velocities of the gyroscope drift and investigate the influence of the dynamic unbalance of the rotor on oscillations and drifts of the shock-absorbed gyroscope. They determine the character of the change in amplitudes of the parametric angular oscillations of the gyroscope with a shifted center of mass during translational vibration of the base. They found quantitative relationships between the moments of inertia of the gyroscope which ensure the smallest amplitudes of its oscillations. Annotation.

Measuring, Testing

USSR

UDC 62-192:621.891

ASSURANCE OF RELIABLE OPERATION OF CAST MAGNESIUM ALLOY FRICTION COUPLES IN A VACUUM

Moscow NADEZHNOT' I KONTROL' KACHESTVA in Russian No. 8, 1976 pp 18-23

TSEYEV, N.A., BOGATYKH, Yu. T., KOZELKIN, V.V., FEDOSOV, A.V.

[Abstract] A study is presented of the friction properties of the alloys MA2-1, VMD-5 and IMV-3 using a friction testing machine operating by the rotary shaft-sleeve principle. The friction properties of the alloys were studied with anticorrosion oxide coatings and without these coatings at various pressures, loads and friction speeds. Some of the porous oxide films were saturated with type MP-605 oil to provide comparative figures and estimate the influence of the oil on the antifriction properties of the film. The studies showed that the friction properties of MA2-1 are better than the friction properties of IMV-3 and VMD-5, both with and without coatings.

USSR

UDC 681.3.004.14:519.2

RELIABILITY OF A SYSTEM WITH PERIODIC TESTING

Moscow NADEZHNOT' I KONTROL' KACHESTVA in Russian No. 8, 1976 pp 49-59

TITENKO, I.M.

[Abstract] A study is made of a system consisting of a certain set of elements which fails upon failure of any one of the elements. The system has a built-in testing device to determine which elements have failed and consequently improve the reliability characteristics of the system. The repairability and reliability characteristics are arbitrary. Assuming that there are errors in testing, the basic indicators of reliability of the system are determined. The possibility is demonstrated of using the system model produced with various assumptions. 2 references.

USE OF ELECTROSTATIC PROBES TO INVESTIGATE THE PARAMETERS OF WALL PLASMA

Novosibirsk VSESOYUZNIY SIMPOZIUM PO METODAM AEROFIZICHESKIKH ISSLEDOVANIY [All-Union Symposium on Methods of Aerophysical Investigations, Collection of Works] in Russian, Text of Reports, 26-29 Apr 76, p 57

VARNAKOV, YU. D., YEPISHKIN, YU. A., PETROVA, T. D., KOZULITSYN, V. T., PETROV, I. L., SEKISTOV, N. A. and MIKHAYLOV, A. V.

[From REFERATIVNIY ZHURNAL, MEKHANIKA No 10 1976 Abstract No 10B404]

[Text] In an electric arc device using a double electrostatic probe with graphite electrodes installed flush with the surface the authors investigated the influence of the products of dissolution of various materials on the level of ion concentration in the boundary layer on a plate. The necessary regimes of flow were obtained with the aid of a profiled nozzle. The parameters of the current are: electron temperature $T_e \approx 2500 - 3000^\circ\text{K}$, electron concentration $n_e \approx 10^9 - 10^{12} \text{ cm}^{-3}$, velocity $V \approx 3.0 \text{ km/sec}$. The Reynolds number $Re \approx 3.6 \times 10^5$, thickness of the boundary layer $\delta \approx 4 - 6 \text{ mm}$. As the working gas they used air. It was demonstrated that the use of several materials leads to an increase in the level of the electron concentration in the wall plasma by one to two orders of magnitude, and the others influence the level to a lesser degree. They obtained a good agreement of the experimental results with the computed data. They showed that the thermoemission effect and the dust content of the surface of the electrode and the dielectric of the probe exert no substantial influence on the probe measurements by the products of dissolution of the plate materials during the experiment. From the texts.

GDR

B 6/8 GD 15 SEISMOMETER BUNDLE--AN ARRAY OF ELECTRODYNAMIC OSCILLATION
TRANSDUCERS

Berlin FEINGERAETETECHNIK in German No 9, 1976 pp 394-396

BURMAN, W., Instrument Construction State Enterprise, Brieselang

[Abstract] The seismometer bundle consists of 6 parallel seismometers spaced 8 m apart. Each seismometer can be fastened into the earth with a stake. The transducer has a double coil, a core magnet, and an adjustable air damper. The output voltage V_o is temperature-independent from -10°C to $+60^{\circ}\text{C}$, and the damping ($\pm 5\%$) is amplitude-independent for V_o up to 0.1 V. The transducer response to an oscillation velocity U $V_o/U \geq 2(m_t R_t)^{0.5}$, where $m_t(\text{kg})$ is the oscillator mass and $R_t(\Omega)$ is the coil resistance. Figures 5; references: 5 East German.

GDR

EXAMPLE OF THE PRACTICE OF MECHANICAL-DYNAMIC DEVICE TESTING

Berlin FEINGERAETETECHNIK in German No 9, 1976 pp 399-402

HAGE, H. J., Information Technology Section, Dresden Technical University

[Abstract] An electronic measuring device was vibration tested both according to the standard TGL 200-0057 and the standard DSRK-XI. It failed the TGL 200-0057 test but passed the DSRK-XI test. The results show that the DSRK-XI standard has the following deficiencies: the upper excitation frequency bound is too low and does not correspond to field conditions; the strength-testing procedure depends on finding resonance locations; and automatic testing with variable sinusoidal equipment is not possible. The essential deficiencies were not removed by the new edition of the test standards, since it does not consider the amplitude or frequency part of actual field conditions. The TGL 200-0057 standard tests the whole device over a broad range of frequency, displacement, and acceleration, is recommended, since it has a better correspondence to field conditions. Figures 2; references: 11 East German.

GDR

OPTICAL-ELECTRONIC DEVICE TO MEASURE MOTION

Berlin FEINGERAETETECHNIK in German No 9, 1976 pp 413-415

GLOESS, R., Electronic Technology and Precision Instrument-Technology
Section, Dresden Technical University

[Abstract] Oscillations with amplitudes up to 5 mm and frequencies to 250 kHz (5 dB limit) can be measured with a 20 nm resolution (100 kHz bandwidth) by a device which projects light from a stationary slit through a slit mounted on the moving object to an electronic photodetector. The output from the photodetector is projected on an oscillograph. The maximum heat loading on the object being measured from the light is 0.5 mW. The object being measured must have an edge in the direction of motion, must be optically opaque, and must be accessible from both sides. The method is not suited for precision measurements because of relatively small amplitude errors in the measurement results. Figures 6; references: 2 East German.

Power

USSR

UDC 621.181.656.001.86

FIRST RESULTS OF THE OPERATION OF A SINGLE-UNIT STEAM GENERATING PLANT FOR A 500 Mw POWER UNIT

Moscow ELEKTRICHESKIYE STANTSII in Russian No. 8, Aug 76 pp 8-10

SUCHKOV, V.I., OSLOPOV, O.I., TSVETKOV, A.K., Urals Affiliate of All-Union Heat Engineering Institute

[Abstract] A brief technical and economic description is presented of the first P-57 Steam Generating Plant, plus the results of the first period of operation and testing of the plant. It is established that the generating plant can operate over a long period of time, reliably and economically under full load at the planned parameters. Flame pulsations did not occur during testing. The dust-handling system of the boiler operated reliably, supporting nominal load of the power plant with six operating mills.

USSR

UDC 621.181.656.004.69.001.5

TRANSITION TO JOINT COMBUSTION OF ANTHRACITE DUST AND HIGH-SULPHUR FUEL OIL IN THE STEAM GENERATING PLANT OF AN 800 Mw POWER UNIT

Moscow ELEKTRICHESKIYE STANTSII in Russian No. 8, Aug 76 pp 10-14

YENYAKIN, Yu.P., MAGADEYEV, V.Sh., YUDAYEV, V.G., LARIONOV, V.F., LINNIK, A.G., DRUG, F.I., SHCHUKIN, Ye.V., All-Union Institute of Heat Engineering, Donetsk Division of State Trust for the Organization and Rationalization of Regional Electric Power Plants and Networks

[Abstract] Recently, the author's institutes have performed a combination of scientific research, planning-design and adjustment operations to organize combined combustion of solid and liquid fuels in steam-generating installations. The studies have resulted in the development of the following main features of the conversion of boilers to combined-fuel combustion: burners are reconstructed to assure effective combustion of both solid and liquid fuel; a portion of the flame operates only with dust, another portion -- only with fuel oil; simultaneous combustion of both types is not attempted, due to the different combustion rates and oxygen requirements; in boilers with two-level and multilevel placement of burners, the solid fuel is burned primarily in the lower levels, the liquid fuel in the upper levels; burner types are alternated to minimize corrosion and deposition on the interior of combustion chambers; in burners with liquid slag removal, in order to assure the presence of a permanent slag film protecting the gunite surfaces, burners are alternated each eight hours from dust to oil and back again. The resulting corrosion rate of low temperature heating surfaces is four to five times less than when oil is burned alone. Studies are required to develop methods for suppression of oxides of nitrogen in combustion chambers with liquid slag removal. 4 references.

USSR

UDC 621.313.333

THE OVERLOAD CAPACITY OF THE AS-4000/6000 ENGINES USED TO DRIVE FEED PUMPS

Moscow ELEKTRICHESKIYE STANTSII in Russian No. 8, Aug 76 pp 31-34

DOLINA, V.I., All-Union Scientific Research Institute for Power Engineering

[Abstract] The overload capacity of the type AS-4000/6000 motor was determined in connection with the changing conditions of their operation as a result of the reconstruction of the feed pumps with which the motor is used, after which the pump delivery increased from 550 t/hr with 10 drive wheels to 640 t/hr with 11 drive wheels. The power consumed by the motor, stator current and slipping increased by 19%, the temperature of the copper of the winding and the steel of the stator rise to 100 and 64 C respectively. This overload mode is the maximum permissible mode, limited by stator winding temperature and can only be permitted if the temperature of the cooling air is not over +25 C. Modernized rotor design to improve ventilation could reduce the rotor rod temperature by 10-15 C and equalize the temperature over the length of the rod. Special measurements of the heating of stators and rotors are required to determine whether overloads of motors are permissible. Simple winding impedance measurements are not sufficient for this purpose.

CSO: 1861

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